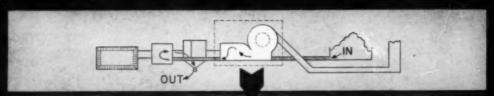
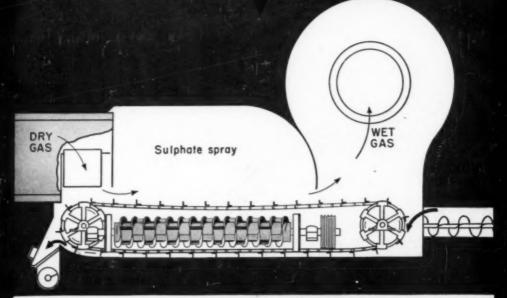
# Chemical Congineering JANUARY 1951





NEW EVAPORATOR DESIGNED TO LICK THE SODIUM SULPHATE PROBLEM, THIS PAGE 106

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Western's experienced workers . . . modern equipment . . . and quality materials help you stop "an stream" breakdown before it starts. Heat exchange failures can often be traced to the fabrication department where the unit or units did not receive the close attention to engineering details and specifications so vital to dependable heat transfer equipment. Western Supply Company has spared no expense in their shop to see that men, materials and machinery of the highest quality are geared and coordinated to produce trouble-free, dependable heat transfer units. All pressure parts of Western's atmospheric sections. shell and tube exchangers, and reboilers are hydrostatically or pneumatically tested to applicable codes. Western heat transfer equipment is tailored right from the drawing board to the finished installed unit.



Above: a corner of Western's machine shop showing a twin installation of multiple spindle drill units. This equipment is employed in drilling box-style atmospheric heads. A standing invitation to visit the Western Fabrication Shop is yours. This closs, wellorganized plant is one more Western step to insure 'time-table service" with quality work.

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San Francisco, Calif.

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WESTER **HEAT EXCHANGERS** 

Manufactured by

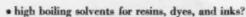
WESTERN SUPPLY COMPANY

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TULSA, OKLAHOMA

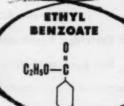
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- ready sources of benzoic acid via ester exchange?
- ingredients for perfumes?

## then check these ALKYL BENZOATES



# BENZOATE

CH<sub>2</sub> CH<sub>3</sub> CH<sub>3</sub>



Isopropyl benzoate is available NOW in commercial quantities; ethyl and butyl benzoates in development quantities. Another member of the series, methyl benzoate, is available in research quantities.

For trial samples or for technical assistance, call or write the nearest Carbide and Carbon Chemicals office today. Ask for our technical bulletin "Alkyl Benzoates," (F-7589). It provides you with additional data and is a permanent reference for your work.

# CARBIDE AND CARBON CHEMICALS DIVISION

Union Carbide and Carbon Corporation 38 East 42ed Street TICE New York 17, N. Y.



## physical properties

	Methyl Benzoale	Ethyl Benzoate	Isopropyl Benzoale	n-Butyl Benzeate
Molecular Weight	136.1	150.2	164.2	178.2
Specific Gravity	1.088	1.048	1.011	1.007
Boiling Point, °C.	198.9	212.8	219	249.4
Vapor Pressure at 20° C., mm. Hg	0.37	0.18	0.12	0.13

Another AO "First" in Protection!

AO R5055' Respirator

Only the AO
Twin Cartridge Respirator
has Bureau of Mines
Approval for protection
against all dusts and
organic vapors
IN ONE CARTRIDGE

Yes, the AO R5055 Respirator (R5000 line) leads the way to a new, convenient standard of safety by protecting against organic vapors and all dusts simultaneously. The "business end" of this protection is the R55 cartridge which contains both a highly efficient chemical absorbent and a cover of chemically treated fell. Result: wearers are safe when both hazards are present and can move freely from dust to organic vaporcontaminated atmospheres or vice versa without changing cartridges.

The R-5055 Respirator with its basic R5000 Face Piece and interchangeable cartridges and disc filter can be quickly converted to protect against

- (1) A combination of all dusts
- (2) Light organic fumes, vapors and gases
- (3) Acid gases, fumes and mists
- (4) Combined acid and organic gases
- (5) Low concentrations of ammonia
- (6) Metal fumes as in welding, burning, smelting, refining

Your nearest AO Safety Products Representative can supply you with this "7-in-1" respirator that gives double the protection.





- · New threaded chemical cartridges
- Famous AO disc type filters
- · Increased visual area
- New face piece
- · New flexible fitting brace
- New port and valve design
- . Double headband



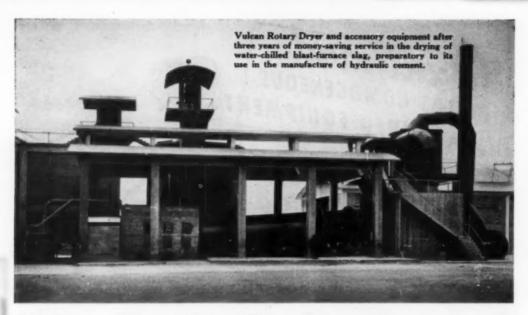
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The Gunthard organization has every facility for fabricating homogeneous lead-lined equipment—from 2 inch carbon steel fittings and all sizes of tanks and vessels, up to massive 90 foot towers.

Skilled personnel fabricate equipment of every type from ferrous and non-ferrous metals including aluminum, stainless, stainless-clad and carbon steels. We number among our regular customers many of the largest and most progressive companies in the nation. If you have a problem that might be solved by expert metal fabrication—with or without lead lining or covering—we invite you to write for complete information on how Gunthard engineering services and facilities can be of provable value to you.

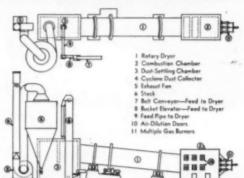
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# Perhaps You, Too, Can Save Money By Getting the Water Out FIRST

If you are shipping, grinding or otherwise processing large quantities of coal, ore, concentrates, etc., containing free moisture, you may be overlooking an opportunity to achieve important savings—by getting the water out first; with a Vulcan Rotary Dryer designed and built especially to suit the job.

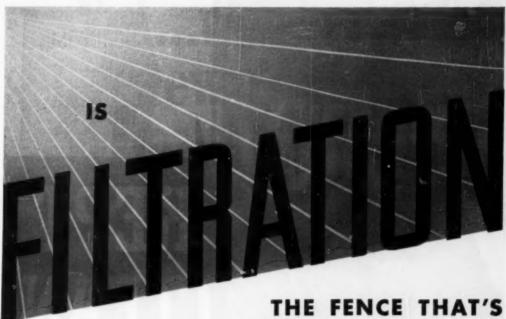
You don't have to guess what the saving will be, because Vulcan Engineers can estimate it quite accurately if provided with sufficient working data. Write us regarding any present or prospective requirement that involves the drying, calcining or cooling of any inorganic bulk material. We'll take it from there and our recommendations will be made without charge or obligation.



Plan and elevation of Vulcan dryer installation shown above. Provision is made for delivering a large volume of hot gases to dryer at relatively low temperature, which can be controlled within narrow limits—also for collecting and reclaiming dust. Other carefully-engineered features assure high efficiency at minimum expense for operation and maintenance.

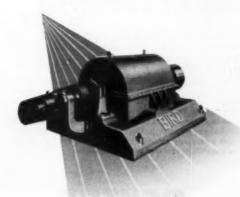
# Vulgan Iron Works Established WILKES-BARRE, PA., U.S.A. Cable Address 1849 WILKES-BARRE, PA., U.S.A. Wilker Barrell William Brown Parks

Other Vulcan Products include Briquetting Machinery, Electric Hoists, Mining Machinery, Open Hearth Steel Castings, Heavy Special Machinery and all types of Industrial Locomotives. Bulletins on request.



# HOLDING BACK Your PRODUCTION?

Filtering can be a slow and messy process — but it doesn't have to be.

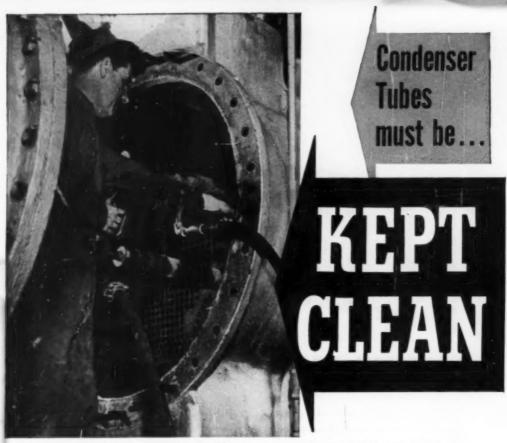


BIRD Continuous Centrifugal Filtration whisks out the solids — micron to half inch size — from thick or thin, hot or cold slurries. It does the job cleanly, quickly, continuously, automatically, economically. No filter cloths to plug and replace. No vacuum. No auxiliaries.

Why not find out exactly what Bird Centrifugal Filtration can do for you? The Bird Research and Development Center is equipped to provide pilotscale facts and figures without delay.

# BIRD MACHINE COMPANY

SOUTH WALPOLE . MASSACHUSETTS



Newport shoots the brushes through the tubes with an air-water gun at 75 lbs. per sq. in. They come from the far end like projectiles. Another Revere contribution was to assist in the design of a target to stop the brushes without damage.

• Condenser tubes almost immediately acquire a film that protects the metal from corrosion. Such film is thin, and beneficial. If it does not form, the probability is that the wrong alloy has been selected. It is part of Revere's service to collaborate with you in selecting the alloy that will be most economical in the long run.

There is another and much heavier type of formation within a tube that impairs its operation, or shortens its life, or both. This is the deposition of foreign matter such as shells, which may cause erosion-corrosion effects, and the growth of organisms such as algae. The latter materially reduce heat transfer.

Take the case of the Newport Electric Corporation, Newport, R.I. Its condensers are cooled by harbor water, with the result that algae and other marine organisms coat the tubes, reducing efficiency, lowering the vacuum, and increasing fuel consumption.

This utility is exceptionally well managed, with a systematic tube-cleaning program. However, it found that brushes and rubber plugs used for cleaning wore out quickly. Revere took a close interest in this problem. One of Revere's customers makes nylon brushes for cleaning tubes in dairies, and it was suggested that

a modification of these be tried. Results: over 300 tubes cleaned per brush, a much longer life than anything previously used, and a half-inch gain in vacuum, meaning dollars and cents saved in fuel.

Revere makes condenser tubes and plates in all the usual alloys, and is glad to collaborate not only in specification, but in other condenser problems, as this case history shows. We are only too glad to work with you on any matter involving condenser and heat exchanger operation. Our wide experience, and contacts with many industries will be made freely available to you. Write the nearest Revere office.

# REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801 230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detrois, Mich.; Los Angeles and Riverside, Calif.; New Bodford, Mass.; Rome, N. Y. Sales Offices in Principal Cibies, Distributors Everywhere,

# Yes...we want to sell Screw Conveyors...

## but more important, we want you to get the most out of them!

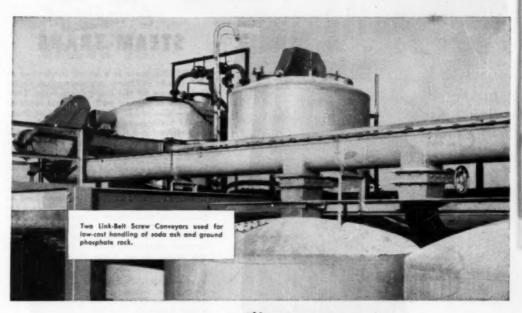
Our job doesn't start or end with selling screw conveyors. More important, our engineers work hand-in-hand with you—or with your consulting engineers...recommend the exact type of screw conveyor to fit your individual application.

Note these features: Link-Belt Screw Conveyors are simple and compact...have less wearing parts. They are precision-made to insure smooth operation and complete interchangeability of parts.

Further, these screw conveyors are available in a full range of diameters, gauges and pitches ... can be made of the metal most suited to your particular job. And Link-Belt can supply all of the components such as collars, couplings, hangers, troughs, box ends, flanges, thrusts, drives, etc. For full information write direct or contact your nearest Link-Belt representative.



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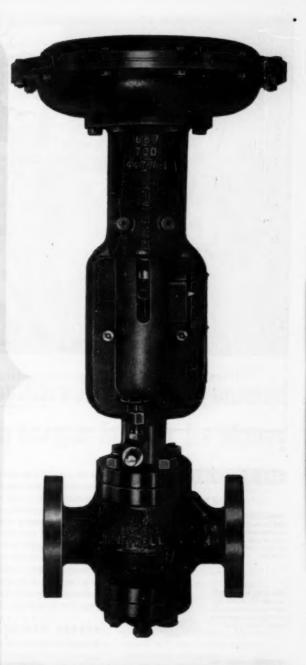


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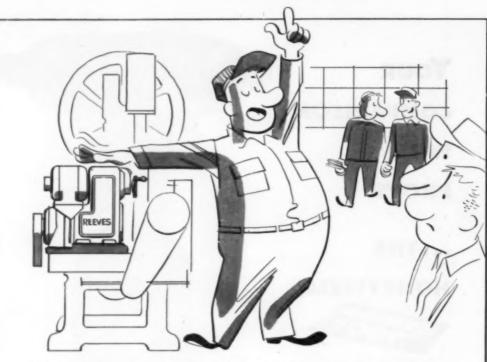
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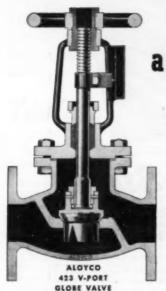
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The photograph above shows a few of the ALOYCO valves that handle the large daily output of sulfuric acid at American Cyanamid Company's Warners plant at Lin-

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## Continuous Use for Nearly 2 Years

These ALOYCO valves have been in valves for corrosive service. uninterrupted service 24 hours a day-without the slightest maintenance-since the unit went on stream April 8, 1949.

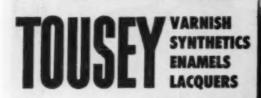
Such performance explains why this American Cyanamid plant has for years standardized on ALOYCO

If your plant deals with corrosives or must guard everywhere against product contamination. think of ALOYCO valves-and Alloy Steel Products Company. Our engineers will welcome the opportunity to work with you.



Y STEEL PRODUCTS COMPANY, INC.

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# perfected by 65 years' experience protected by Tri-Sure Closures

Back in 1885, the Tousey Varnish Company started as a one-man business.

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Tri-Sure Closures assure the success of a vital step in the marketing of liquid products. They provide with a *leak-proof*, *tamper-proof* closure—perfect security from spoilage and losses in transit.

Tri-Sure protection always pays, because it can be costly to be without it. On your next drum order, specify "Tri-Sure Closures". Your drums will be delivered to you equipped with Tri-Sure Flanges and Plugs; you apply the Seals.

Tri-Sure

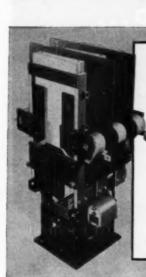
CLOSURES

"The "Tri-Sure" Trademark is a mark of reliability backed by 28 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

The photograph above is reprinted from "65 Years of Achievement", with the permission of the Tousey Varnish Co.

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# Which Contactor is Best for You?



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- 1. Easier and cleaner to maintain,
- 2. Contacts last longer.
- Preferred for highly repetitive duty.
- Reduces fire hazard.
- Type 256 fits in same cubicle as an oil immersed contactor.



# OIL

- Can be used in dust laden atmospheres.
- 2. Atmospheric contamination will not interfere with operation.
- with operation.

  3. Lower initial cost.
- 4. Less space for Reduced Voltage Starting.
- 5. Thousands giving satisfactory service.

# You can get either in

OIL OR AIR — whichever contactor is best suited to your application can be built into Allis-Chalmers Type H Starters. Both are designed for ready access . . . built to give long life with low maintenance. And regardless of the contactor you select, all Allis-Chalmers Type H Starters give split-cycle short circuit protection through current limiting fuses.

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# Q.C.f. cylindrical plug valves

They alone provide the full-pipe-area passage, and straight-through round\* porting, that can banish abrasion troubles. Lubricant-sealed from contact with the lading, the precision-machined plug does not wear or need attention, other than an occasional turn of the lubricating screw. Why use less efficient valves?

\*Alsa evallable with full-pipe-area rectangular port.

# Q.C.f. PLUG VAL

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# a new and proven tool in metallic and non-metallic minerals and chemical processing



dro-conical classification unit utilizing centrifugal force in place of gravity. It provides a new method of separating finely divided solids in liquid suspensions and constitutes an important new tool with which to supplement current established practices.

### RESEARCH AND DEVELOPMENT

Development of the DorrClone (DSM Cyclone) was begun in 1939 by the Dutch State Mines in The Netherlands, where a continuing research and development program has been carried on since that time. The Dorr Company, as exclusive licensee under the Dutch State Mines patent rights in all fields other than that of heavy media separation, has been actively engaged since 1948 in development work relating to design variables affecting performance, materials of construction and possible fields of commercial use. The result of this program is a carefully engineered unit, capable of controlled and predictable operation.

## PRESENT AVAILABILITY

DorrClones are now available singly or in multiple arrangements in four standard sizes: 3", 6", 12" and 24" diameters.

### **APPLICATIONS**

Standard units are now limited to separations in the 20 micron to 100 mesh range but present studies indicate broader applications in the future. Typical commercial applications proven to date are:

Degritting of viscous suspensions such as milk of lime and clay slucries.

Desliming of metallurgical pulps, phosphate rock, coal, iron ore and tailings for mine backfill, with the production of extremely dense underflows where such are desired.

Classification of crystalline and other granular suspensions.

### PATENTS

The DorrClone is covered by patents issued and pending in the United States and other countries.

Further information... We welcome inquiries on specific problems and applications and are prepared to undertake engineering investigations within the scope of our present knowledge and experience.

\*DorrClone is a Trademark of The Dorr Company

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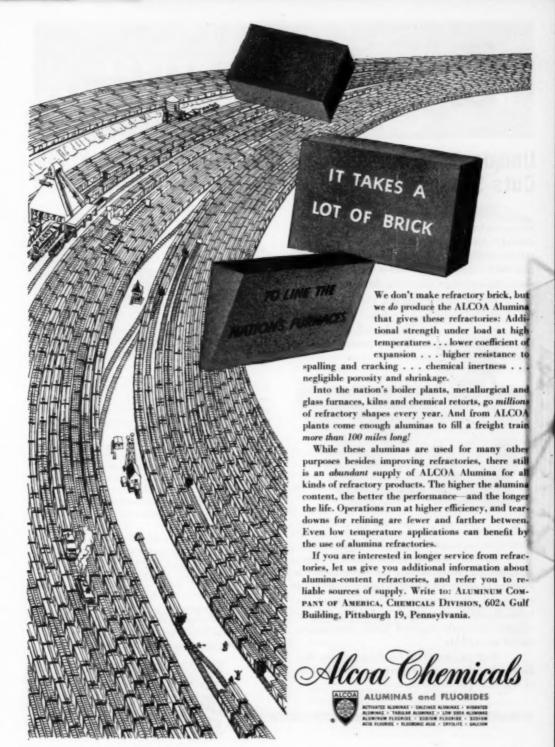
BUFLOVAK Vacuum Rotary Dryers are built in various designs and sizes, including sanitary types, to meet every industrial requirement. Special features may include dust-tight housing for charge and discharge doors, equipped with locking devices and lifting mechanism. Built-in spray nozzles can be furnished to flush the dryer.

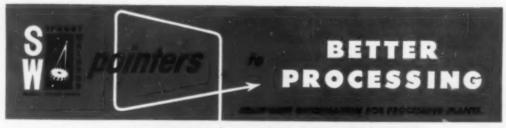
DIVISION OF BLAW-KHOX CO. 1551 FILLMORE AVE., BUFFALO 11, N. Y.

BUFLOVAK RESEARCH and TESTING LABORATORY

To essist you in the solution of processing problems, BUFLOVAK offers the facilities of its Research and Testing Laboratory-where small scale experimental units show you, before you buy, the commercial possibilities, data on production cost, and characteristics of the finished product.

**BUFLOVAK BUILDS** 



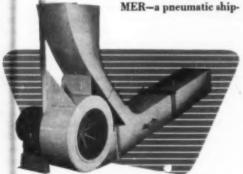


# **Unique Grain Trimmer Cuts Stevedore Costs**

At best, the loading of ocean-going vessels with grain has always been a slow, disagreeable, and costly job. Getting the grain from the elevator chute into the hatch is simple enough, but storing it away into the far corners of the holds is a dusty, handshoveling operation requiring three to six men.

But, B. H. Sobelman & Co., Inc., Stevedores, of Philadelphia, have found the answer!

It's the GRAIN TRIM-



loading device developed and built by Sprout-Waldron in cooperation with B. H. Sobelman & Co.

Lowered into the hatch with the ship's gear, this unit receives the grain direct from the elevator chute and forces it at high velocity on a column of air into inaccessible corners of the holds. Result: Grain cargo is loaded in a fraction of time previously required. Labor costs are reduced accordingly.

Your own materials handling problem may be as adaptable to our experience and facilities as was this specialized need.

# **Dyestuff Plant Gets** Product Uniformity . . . with vertical mixers!

An organic dyestuffs manufacturer was faced with the problem of maintaining batch uniformity . . . on a continuous basis. Horsepower and floor space economies were also important factors.



The solution was found in a battery of four 150 cu. ft. Sprout-Waldron Vertical Mixers which serve as mixing reservoirs. In these units, successive batches of dyestuffs are thoroughly distributed among several preceding batches to assure continuous uniformity of finished product.

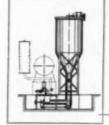
Each unit requires only five square feet of floor

space-operates on 5-7 horsepower. A single color is assigned to each mixer, completely eliminating color contamination and frequent cleaning.

This vertical mixing installation is dust-proof throughout, making for a compact, safe, and clean operation.

Stock emerging from a dryer is first passed

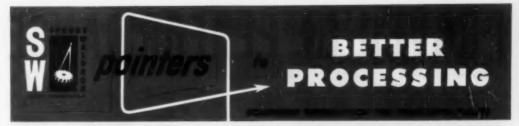
through disintegrating mill which breaks up compacted lumps without excessive temperature rise. This mill is fitted with properly vented surge hopper and a horizontal screw leading to the vertical mixer.











# Size-Reduction May Be Your Problem, Too!

Shellbuilder Company faced it in Houston, Texas over 25 years ago.

The product to be crushed was oyster shell. Uniformity of size range was a requisite—with capacities in tons per day. Average temperature of product at the time of grinding 200° F.

Obviously, the equipment for this work had to withstand severe punishment without expensive breakdowns. Product cost per ton had to be competitive in a world-wide export market.

Shellbuilder's choice in 1925 was two Sprout-Waldron 36" Double



Runner Attrition Mills. Today, these same units are still in use. Capacity is still high. Plate life — 1600 tons of oyster shell per set!

Many industries are rediscovering the basic advantages of this trouble-free mill on such varied assignments as grinding, cutting, shredding, pulverizing, granulating, etc.

# Spatula Test-Yardstick of Perfect Blending



Powdered insecticides and fungicides must be uniformly blended and free of lumps. This is particularly important when the modern method of airdusting is used for crop protection.

The Vahlsing Insect and Disease Control Service of Robbinsville, N. J. is one of the leading companies in the East engaged in air-dusting. Here is what Joseph P. McKenna, General Manager of the Vahlsing plant says about their S-W Blending Systems:

"Our equipment turns out a perfectly blended dust-free from streaks, at a most satisfactory rate. The Spatula Test proves our products have nothing to fear from the competition."

If you want to blend powders 100 mesh and finer, or combine them with liquids or fibers on a tonnage basis, a Sprout-Waldron Blending System is likely to

offer you distinct advantages.

Here are just a few
diversified products
blended in Sprout-Waldron
Systems: weed killers \* industrial cleaners \* ceramic

bonding formulas · livestock
mineral tonic blends · asbestos brake-lining formu-



# PROVED IN PERFORMANCE

Grinnell-Saunders Valves with
CHEMICALLY INERT
KEL-F

Grinnell-Saunders Diaphragm Valves with KEL-F Diaphragms are living up to every promise made for them! At the right are reports from typical users.

KEL-F's resistance to chemical action, low cold flow, wide range of temperature application and exceptional flex life combine to make it the most important diaphragm development in years. KEL-F is chemically inert to all organic acids and alkalies in all concentrations. It withstands chlorinated aliphatic and aromatic compounds, concentrated nitric, chromic, hydrofluoric and sulphuric acids and most solvents which readily attack rubber and previous synthetic diaphragm materials.

While KEL-F is tough and flexible, it is not resilient. To provide resiliency for proper closure of the valve and to provide added support for the KEL-F diaphragm, it is backed with a rubber cushion. A free-floating method of attachment to the compressor assures an even closing pressure on the entire surface of the weir. A tube nut which floats as the rubber cushion presses down in closing the valve, eliminates excessive pressure on the diaphragm stud. The rubber cushions the closing force, thereby reducing wear and cutting action on the diaphragm. In accelerated tests, a 2-inch valve with a KEL-F diaphragm withstood over 80,000 closures, drop tight, against 80 pounds of air under water with no leakage and no visible signs of wear. Write for complete information.

### Typical performance reports . . .

- Chlorine and HCl gas with small amounts of acetic acid and acetyl chloride at 302° F. for 900 hours. Very much superior to material it replaced.
- Mixed aromatic and ketone solvents at 230° F, and 10 psi for three months. No sign of deterioration.
- Chlorinated organic chemical at 158 to 194° F. and 30 to 40 pai for nine months. No failure, no shutdown, no replacement.
- Chromyl chloride at ambient temperature and 15 psi. Diaphragm condition good at end of thirty days' test.
- Liquid chloral saturated with HCl at 158° F. for 408 hours. Well satisfied — have placed orders for additional diaphragms.

"KEL-F" is the registered trade name for polytrifluorachlarethylene, an acceptionally stable thermoplastic. It is produced by the M. W. Kellagg Co.

# GRINNELL



GRINNELL COMPANY, INC., Previdence, R. I. Warehouses: Atlanta \* Billings \* Buffale \* Charlotte \* Chicag Cleveland \* Cranston \* Frasno \* Kansas City \* Houston \* Long Beach \* Las Angeles \* Milreaukee \* Minneapolis \* New Yor Oakland \* Philadelphia \* Pocatelle \* Sacramento \* St. Lavis \* St. Paul \* San Francisco \* Seettle \* Sackus



# FRUEHAUF has, or can build, a TANK-TRAILER for every liquid hauling need!

FRUEHAUF

THE problems of hauling chemicals and chemical products are many and varied, and each demands special requirements of the vessel containing it. For this reason most chemical hauling tanks are "Specials." Fruehauf, the leading builder of Tank-Trailers, has probably built a unit with special features to haul your load, and . . . with all the outstanding qualities of a Fruehauf. Strength, durability and light weight are never sacrificed for special load carrying features.

# Your Problem May Be DIFFERENT!

When you have a special problem of hauling, let Fruehaul build a Tank-Trailer for your particular needs. Problems such as flow, temperature and safety are solved by a staff of Trailer Engineers, and the unit built by skilled Fruehaul technicians. The result is an economical, long-lived Tank-Trailer built for the job, and backed by the world's largest builder of Truck-Trailers.



A new and comprehensive guide-book on Tank-Trailers is available upon request. It illustrates and describes many chemical hauling units as well as the standard line of Fruehaul Tank-Trailers.

WRITE

FRUEHAUF TRAILER COMPANY
DETROIT 32. MICHIGAN

FRUEHAUF Trailers

WORLD'S LARGEST BUILDERS OF TRUCK-TRAILERS

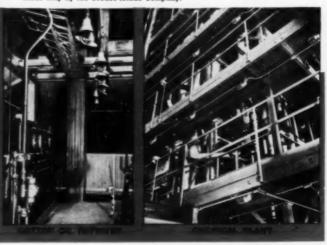
# CONDULETS\* and rigid conduit

YOU can
install galvanized
CONDULETS and
galvanized rigid conduit
under all
atmospheric conditions
and in all occupancies

(See Article 346, Section 3462, National Electrical Code.)

The CONDULET and rigid conduit method meets the requirements of the National Electrical Code in locations exposed to weather, heat, moisture, steam, vapor, dust and dirt or locations that are hazardous because of the possibility of the presence of flammable gases or vapors, or combustible dusts. The same sterling qualities that make CONDULETS the first choice in these special applications, make them first choice in ALL ordinary locations.

\*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.



# ... the UNIVERSAL wiring method

"for MODERN WIRING ...

the CONDULET and conduit method

gives you definite advantages"

- MECHANICAL PROTECTION . . . Rigid conduit and cast Feraloy CONDULETS provide the best possible protection against accidental damage to the wiring and equipment. Prevents costly shutdowns.
  - SAFETY . . . A CONDULET installation gives maximum protection against personal injury and fire. The continuous conduit system made up with taper threaded CONDULETS provides a reliable and permanent low resistance path to ground.
  - FLEXIBILITY . . . To meet all the diverse requirements of modern electrical layouts, CONDULETS are made in a wide variety of shapes and sizes with varied hub arrangements, including a full line of CONDULETS with detachable hub plates.
  - ECONOMY . . . The installed cost compares favorably with other methods, while the total cost over the years is definitely lower, due to the durability, reliability, sofety, and low maintenance cost of a CONDULET and rigid conduit system.
- CORROSION RESISTING . . . Galvanized cast Feralcy CONDULETS offer the best protection wherever moisture, dust or corrosive atmospheres are present.
- QUALITY . . . The trademark CONDULET stands for reliability and long life. Every CONDULET is built to Crouse-Hinds high standard of quality with painstaking care by skilled craftsmen.
  - On YOUR next electrical layout, for any location, plan to get all the benefits of study cast Feralcy CONDULETS and rigid conduit... the UNIVERSAL wiring method. More than 15000 types and sizes are listed in the CONDULET Catalog.

**CROUSE-HINDS COMPANY** 

Syracuse 1, N.Y.

Gillere Birtninghum – Buttin v. Buftin – Chicogo – Carrianet – Clevelind – Dellin – Davega- il 184 Boutin – Informaçuin – Rannan Cary – Lea Angalon – Billevoltus – Bittangepila – Ber ville, Paladediphin – Frindurch – Furtined Cox – Sur Pruncisco – Secrib – St. Lesius – Washington, Bezinter Birgenesisteres – Khong — Adaton – Buftineses – Chrotine – Hew Chroma – Richmond, Va.



# HIGH GRADE PROFITS from LOW GRADE FATS

# BLAW-KNOX BUILDS COMPLETE PLANTS FOR:

### 1. FAT SPLITTING

The purent Colgare-Emery Process hydrolyses fate into fatty acids and glycerin with an efficiency of 98% or higher. No catalyst is required, steam consumption is low, and the through-put capacity is high considering the small plant size.

### 2. FATTY ACID DISTILLATION

Fasty acids produced by splitting are up-graded or improved in quality by distillation. By fat splitting and fatty acid distillation, high grade fatty acids can be produced from low quality fats.

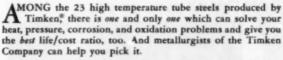
## 3. FATTY ACID FRACTIONATION

Mixed fatty acids can be separated into individual acids or fractions having certain desired properties. A combination of the Eq. (a) solvent crystallization process and fractional distillation under vacuum may be required for rigid requirements.

Chemical Plants Division designs and builds these process units, either individually or in combination, to produce high grade fatty acids from how quality fats. We welcome an opportunity to submit recommendations for a process unit to manufacture the product you have in mind.



# Which one of 23 high temperature tube steels do you need? Ask the experts!



These metallurgists are recognized authorities in high temperature steels—have 21 years of experience and research behind them. With 23 analyses to choose from they can recommend the one best tube for your job. And whichever tube you use, you can be sure of uniform quality; Timken closely controls quality from melt shop through final inspection.

Let Timken's "RSQ"—Research, Supply, Quality—solve your high temperature tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

This month Timben reports on:

## SICROMO 21/2

Suitable for applications in subich correction vention is a major consideration, but subere conditions do not is a major consideration, but subere conditions do not is a major consideration resistance compare favorably strength, and exidation resistance compare favorably strength, and excluding resistance compare favorably strength, and exchanges, superbeater tubes, vapor and tubes, boat exchanges, superbeater tubes, vapor and tubes, boat exchanges,

# ONE OF 28 TIMES HIGH TEMPTRATORS ONE OF 28 TIMES HIGH TEMPTRATORS Sicromo 2 Sicromo 5MS 25-20° 25-212°

Carboo-Mo. Sicromo 24 Sicromo 7 25-12\*
DM-2 24% Ce-1% Mo. Sicromo 9 35-15\*
Silmo Sicromo 3 18-8 Staisless
DM 4-6% Ce-Mo.-Tl. 18-8 Cb

2% Cr. Mo. 4-6% Cr. mo. 1.

Photo shows metallurgist at Timben determining the lattice structural characteristics of an alloy with X-ray diffrastion aquipmont. Research like this is a hig reason for Timben's leadership in high temperature steels.

YEARS AHEAD -THROUGH EXPERIENCE AND RESEARCH





Specialists in alloy steel—including hot rolled and cold fluished allog steel bars—a complete range of stainism, graphitic and standard teal analyses—and allow and stainisms accombine state tubing

# G-E SYNCHRONOUS

SAVE MONEY



SAVE ON OPERATING COSTS . . . Municipal plant gets higher efficiency by continuous operation of constant speed of three 500 horsepower, 1.0 power factor, G-E synchronous motors, each coupled to a sentifugal storm-sewer pump.



SAVE ON INITIAL COST... Paper mill selected this 4000 hp, 200 rpm, G-E synchronous mater for driving the montague grinders at low speed. Maximum operating efficiency thus resulted.



# MOTORS CUT COSTS ... improve performance

## IT'S ON THE RECORD ...

Lower operating costs higher operating efficiency

Lower initial cost including control and exciter for many ratings

Reduced demand and release of needed generating capacity

Reduced power rates for improved power factor

For your next large, constant-speed motor, ask your General Electric sales representative to tell you how you can take full advantage of the money-saving features of G-E SYNCHRONOUS MOTORS. Or write for bulletins GEA-5332 (low-speed) or GEA-5426 (high-speed) on your letterhead to Section 770-22, Apparatus Department, General Electric Company, Schenectady 5, New York.

## GAIN EXTRA PERFORMANCE



DEPENDABILITY . . . Extra protection against physical damage, electrical breakdown, and operating wear and tear makes tri-Clad\* maters highly suitable for sawmill operations. Here is a Tri-Clad synchronous mater rated 300 hp. 1200 rpm, driving an edger in an Oregon sawmill.



LONG LIFE... All welded steel-plate stators assure a permanent solid core, and bex-type construction means a rigid frame. This 35 hp, 0.8 p.f. G-E synchronous motor, coupled through magnetic clutch is matched to a fun pump which delivers stack to paper machine.

## SIMPLIFY OPERATING PROBLEMS



APPLICATION ENGINEERING... Engineers with many years of field experience will tailor synchronous motors to fit your needs. An example is this largest synchronous motor (in horsepower) ever to be applied to drive a reciprecating compressor; 0-E motor rated 4500 hp, 300 rpm, driving a Clark gas compressor.



SERVICE . . . No matter where your plant is located, you will find General Electric service close at hand. Experienced engineers of our local offices, and trained staffs from our Service Shops are always at your command.

NOT AN ENAMEL.

Solid

# Porcelain

NON-POROUS THROUGH-AND-THROUGH

The dependability and long life of the Lapp Valve is due to its sound design, and to the fact that it is made of porcelain . . . body, plug and packing rings. Not a coating or enamel, porcelain is a dense, homogeneous, thoroughly-vitrified ceramic, non-porous, through-and-through acid resisting. Not even is the corrosion-resist-

ance of this material due to a glaze. In fact the "working parts" have no glaze. The smooth operation and pressure-tight seal characteristic of Lapp Valves result from precision-tolerance machining ... grinding and lapping of solid porcelain to a mirror-like smoothness.

Valves and other equipment of Lapp Chemical Porcelain may be the answer to your corrosion problems. Write for literature. Lapp Insulator Company, Inc., Process Equipment Division, 401 Maple St., LeRoy, N.Y.

# Lapp PROCESS EQUIPMENT CHEMICAL PORCILAIN VALVES . PIPE . BASCHIG BINGS

PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

# ATTAS GAS ALARM

Instantaneous Detection of Explosive Gases. Compact, portable instrument is NOW AVAILABLE through Atlas Exploration Co.

PROVED IN USE, DEPENDABLE, EASY TO OPERATE, ECONOMICAL, proctically no maintenance involved. Portable or stationary equipment available.

### NOTE THESE FEATURES:

ATLAS GAS ALARM (Stationary or Portable)

Stationary or probe explosive gas detection, automatic instantaneous alarm and warning light.

### FEATURES:

Plug-in Probe or element on side of case \* Weather Proof Steel Case \* Percentage of Explosive, Continuous Readings, and Gas Volume Percentage Chart - Detector Element outside of Instrument - Fully Enclosed, Dust Free, Electrical System - Separate Battery Compartment - Spara Detector Elements - Enclosed Buttery Charger.

### ATLAS PROBETECTOR (Portable)

For use in chemical, refinery, public utilities and general industries.

### FEATURES:

ATLAS PROBETECTOR

Attas Unique Probe—Super Safe Fully Enclosed Flame Arrestor \* No Aspirator Bulb \* No Flimsy Suction Hose \* Calibrated for Lower Explosive Limit of Gases to Specific Requirements \* Positive Instantaneous Gas Measurement, Simple to Operate . Longer Life, Constant Voltage, Rechargeable Battery . Extra Element Holders (dust and weatherproof) . Automatic Shut-Off Switch . Weather Proofed Steel Case . He Dilution of Gases . No Voltmeter.

Sales Representatives Wanted

Write for literature, price list, and any engineering service

# AS EXPLORATION COMPANY

19TT WEST ALABAM

For Maximum
Resistance to
Corrosion
Be Sure
to Specify...



THE LOUIS ALLIS

GIEMICAL MOTOR

Heavy cast bronze ventilating fan.

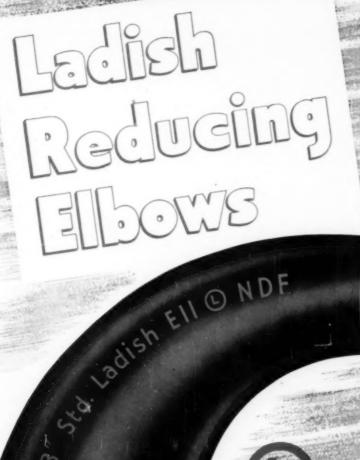
Stainless steel motor housing shel

Heavy cast iron motor housing with integrally

THE LOUIS ALLIS CO

This new motor has been specifically designed and constructed to withstand the corrosive conditions encountered in chemical plants, oil refineries, and other similar operating conditions.

For further information contact your nearest LOUIS ALLIS Sales Engineer.





FLOW EFFICIENCY

Uniform, gradual reduction in diameter from tase to tase of the fitting, plus full, effective confur-lini tradius reduces turbulense an resurse maximum flow efficients



SEAMLESS DESIGN

The first practical Seamless Reducing Elbew, this Ladish develupment for which a patent panding, is formed in one pies promiting to the proper stury from high quality seamless to the foreign temper stury.





FASY TO INSTALL

Welding and installation time is reduced by these Ladish Reducing Elbows which eliminate the need for handling and welding additional fitting.

SAVE WELDING COST - SAVE AN EXTRA FITTING SAVE LOSS IN FLOW EFFICIENCY - SAVE SPACE

A single Ladish Seamless Reducing Elbow eliminates the 90° Elbow and Reducer formerly needed to change direction of flow and reduce pipe size simultaneously. This effects considerable installation economies...saving one weld and one fitting at each location... with the added advantage of accomplishing the reduction in less space. In addition, the smooth, gradual reduction in diameter of Ladish Reducing Elbows offers less resistance to flow.

Ladish Reducing Elbow Size Range—2" x 1" through 12" x 6" in Standard and Extra Strong Weights. Seamless through 6" x 3".

THE COMPLETE Controlled Quality FITTINGS LINE PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

PATENT PENE

LADISH CO.

CUDAHY, WISCONSIN

District Offices: New York + Buffale + Pithburgh + Philodelphia + Cleveland + Chaoga St. Paul + St. Louis + Atlanta + Houston + Tulia + Las Angeles + Havona + Teronta



# Dependable "ON-OFF" Controllers for Industry

THE kind of control instrument which industry calls on-off or 2-position is not only the oldest form of automatic regulator, but is one which many manufacturers still use, instead of more advanced types, for simple requirements. Usually, the instrument merely closes the valve when temperature reaches the control point, and opens valve again when temperature falls below point. The question of whether such on-off action is best for the given case can of course be settled by using the instrument with the best, most useful features. Here are some which L&N On-Off Controllers offer:

 Instruments may be Recording Controllers with either strip-chart or round-chart, or Controllers with no charts at all.

Instruments can operate at high or moderate speed; can be located regardless of machine vibration, building tremors or distance from process.

3. Controls are outstandingly dependable because they "balance" temperature against a standard. Intermediate bearings and springs cannot increase, decrease or otherwise influence accuracy or sensitivity.

Low maintenance assured by machine-like design and construction.
 More than 1000 standard ranges. Specials are available, but seldom needed.

Tell us your problem and we will send further information. Write either to our nearest office or to 4916 Stenton Avenue, Philadelphia 44, Pa.



ELECTROMAX ON-OFF CONTROLLE

MEASURING INSTRUMENTS - TELEMETERS - AUTOMATIC CONTROLS - HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

THESE instruments are fully automatic; need no standardizing; are ideal even for hard-toget-at or difficult locations.

# "Everything considered..." means lower calcining costs

means lower calcining costs with a Traylor Rotary Kiln

Roller supports are important to economical Rotary Kiln operation. Traylor supports are quickly adjustable to maintain perfect shell alignment for trouble-free, low-cost calcining. Traylor offers several types of roller supports . . . recommends the type best suited for each installation.

Everything ... even the most minor detail ... is carefully considered before Traylor builds a Rotary Kiln. 40 years of experience has demonstrated to Traylor that the smallest details ... as well as the more obvious factors ... play an important part in every efficient Rotary Kiln installation. Place your calcining problem in Traylor's hands where "everything considered" means lower calcining costs for you.

Fraylor

Rotary Kilns, Coolers and Dryers · Grinding Mills Jaw, Reduction and Gyratory Crushers · Crushing Rolls

MAIL THIS COUPON
FOR FREE TRAYLOR KILN BOOKLET

TRAYLOR ENGINEERING & MANUFACTURING CO.
303 MILL ST., ALLENTOWN, PA.

Send me your latest booklet on the operating advantages of Traylor Rotary Kilns.

Name.

Company.

Address.

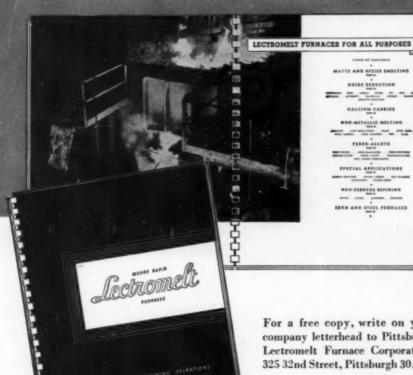
SALES OFFICES: New York, N.Y.; Chicago, II., Lee Angeles, Calif. Canadian Mirs: Canadian Victors, Ltd. Montreal, P.Q.

A "TRAYLOR" LEADS TO-GREATER PROFITS

CHEMICAL ENGINEERING-January 1951

you're interested in doing any of these things with an Electric Furnace.

you need this new book



BON-METALLIC MELTING Section Control Sections Section 19 SPECIAL APPLICATIONS HOH-PERROUS REFINING

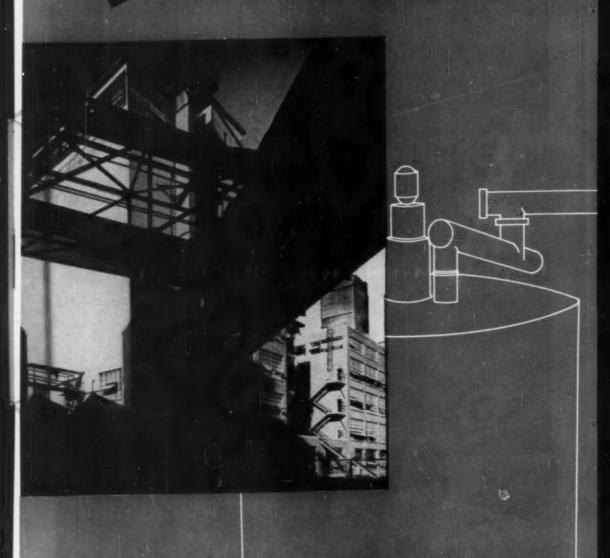
For a free copy, write on your company letterhead to Pittsburgh Lectromelt Furnace Corporation, 325 32nd Street, Pittsburgh 30, Pa.

WHEN YOU MELT... ECTTOM &

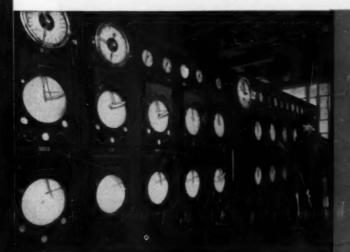








# APPROACH Oxtraction



### \* BROWN INSTRUMENTATION

- ... is patterned to the exact requirements of individual plants and
- ... is the result of engineering and application know-how, with one responsibility from sensing elements to control valves.
- ...is backed by a nation-wide field engineering and service organization

Continuous solvent extraction is the modern method of extracting vegetable oils in use at the Glidden Company's new plant in Indianapolis. This plant, constructed by Blaw-Knox and utilizing their Rotocel, incorporates advanced engineering and instrumentation techniques to obtain maximum yields of soybean oil at lowest costs.

The entire operation is automatically controlled by Brown instruments mounted in a centrally located board. Indicating and recording temperature, pressure and flow controllers comprise a coordinated system of Brown instruments that maintains critical variables at their desired values, When looking for automatic recording and controlling instruments for your solvent extraction

operations, or any chemical process-consider first:

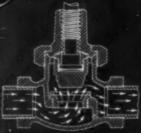
- The Brown know-how developed through many years of application experience in the industry.
- The completeness of the Brown modern approach—recorders, controllers, panelboards, valves and all accessories.

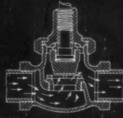
Call in our local engineering representative for a detailed discussion of your process requirements ... he is as near as your phone. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 4478 Wayne Ave., Philadelphia 44, Pa.

Honeywell

# POWELL gives you Full Flow in a Throttling Valve





COMPARE

the flow characteristics of the new Powell "W.S." Valve (left) and the ordinary globe valve (right). Note the extra large opening through the swat (nominal pipe size) and the greatly increased lift of disc, when wide open.



This is actually a dual service valve in that it can be throttled to any desired degree, yet, when wide open, permits FULL FLOW through the body. Thus turbulence and pressure drop are reduced to a minimum—a triumph in engineering that exemplifies Powell's continual leadership in the field of industrial valve design.

Powell "W. S." Bronze Globe Valve Fig. 2608

Write for folder giving full description of the many advanced engineering features of this valve.

# POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio



# 60-Week Corrosion Battle Proves <u>life-Line</u> Chemical Motor Easy Winner

Two motors—one a CS cast-iron motor, accepted by industry as the best available for chemical service; the other a Life-Line all-steel chemical motor—were placed in a salt spray tank July, 1947. 10,007 hours later (approximately 60 weeks) they were removed. The unretouched photographs offer visual proof of the Life-Line chemical motor's superiority.

This Life-Line chemical motor offers more protection against corrosion than any motor we've ever built. It's protected at every point.

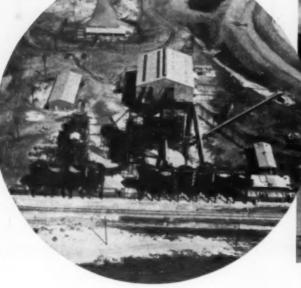
Frames, brackets, feet are Bonderized; then given four protective coatings. The first is a formaldehyde alkyd-type enamel, well known for its superior corrosion resistance. To assure perfect bonding, it is baked for 30 minutes at 250° F. Two dips and bakes of tough, flexible Thermoset varnish are then applied. Finally, the exterior finish coat of gray lacquer is sprayed on.

Stator windings, too, are double dipped and baked in Thermoset. A bronze blower provides adequate cooling . . . stands up to tough corrosive atmospheres. Neoprene bearing seals are an added precaution. Bearings are factory-sealed and prelubricated . . . need no further lubrication.

These extras provide the kind of performance shown by the above example. Need something extra in a motor? Extra protection against corrosion . . . against outages from any cause? Check the Life-Line. Ask your Westinghouse representative for a copy of Chemical Motor B-4657, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



# 14 Horton Tanks Used in Florida Mining Operation





Two 30-ft. diam. desliming tanks, one 27½ ft. high and the other 25 ft. high, containing a mixture of sand, small phosphate pebbles and mud ready for processing.



Ten 22-ft. diam. by 18-ft. phosphate tanks. Coarse material is stored in the four shown at the far left and concentrates are stored in the six tanks in the foreground.

The American Cyanamid Company recently opened its second phosphate rock mine east of Tampa. This open-cut operation, known as the "Sidney" mine, annually helps supply hundreds of thousands of tons of phosphate rock products to agricultural and industrial users throughout the world.

Fourteen Horton welded steel tanks are used in a process that takes phosphate matrix from nearby deposits . . . breaks it up . . . washes, screens, and deslimes it . . . and then recovers it for storage and shipment.

Four 50-ft. diam. processing tanks deslime a fine slurry of sand, phosphate pebbles and mud, and hold it for transfer to the flotation plant. Ten 22-ft. diam. hopper bottom tanks are used to store both coarse phosphate pebbles and fine concentrate preparatory to shipping.

Specialized tank construction offers no obstacles to our design, fabrication and erection departments. Their knowledge enables them to tackle any problem with complete confidence. If you have a tank problem, consult our nearest office.



50-ft. diam. by 13-ft. welded steel processing and feed storage tank. It is one of four such units used to deslime fine slurry and store is until it's fed into the flotation plant.

#### CHICAGO BRIDGE & IRON COMPANY

Atlanta 3		ldg.
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Illustrated—a few of many types of Sylphon Packless Valves. Sizes range from '5" to 6". No. 304-NV is especially suited for vaccount service.

### Sylphon Packless Valves prevent leakage—in or out

• Once Sylphon Packless Valves are installed on pipe lines carrying gasoline, oil, or other volatile liquids and vapors, leakage stops instantly! You and your equipment are protected against possible fire, explosion or other damage. You gain more, too. For these valves prevent wastage — provide vacuum protection.

There's no packing to leak or replace. A rugged, seamless Sylphon metal bellows replaces customary packing. The bellows eliminates leaks that might seep past the stuffing box of even the best packed type valve. It seals the valve stem against corrosive, dangerous or inflammable liquids or gases.

Many sizes and types made of brass, monel, stainless steel, etc. Widely used in chemical plants, oil refineries, power plants, aboard ships. Ideal as standard equipment. Get complete information; write for Bulletin AC-813.



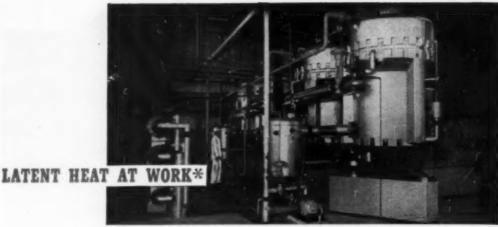
Temperature Controls . Bellows Devices . Bellows assemblies

FULTON SYLPHOR

FIRST WITH BELLOWS

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4. TENN.

Canadian Representatives, Darling Brothers, Montreal



Cleaver-Brooks Compression Stills at Arrowhead & Puritas Waters, Inc., Los Angeles, Calif. This plant is one of the largest compression still installations in the U.S., producing over 100,000 gallons of pure water daily,

### Cleaver-Brooks Compression Stills offer Exceptional Economy in 3 Basic Applications:

water purification in quantity and quality. Potable water can be obtained from brackish or sea water—no need for pipe lines, trucking or barging from distant sources of fresh water. Where potable water is available a Cleaver-Brooks Compression Still produces a USP chemically pure, pyrogen free water, meeting the rigid standards demanded for intravenous solutions or chemical processing.

Concentration for RECOVERY Cleaver - Brooks Compression Stills recover valuable solids from fluid wastes from tanning liquors, brine, amino acids, penicillin slurry, black liquor from pulp-paper mills, other solutions and substances.

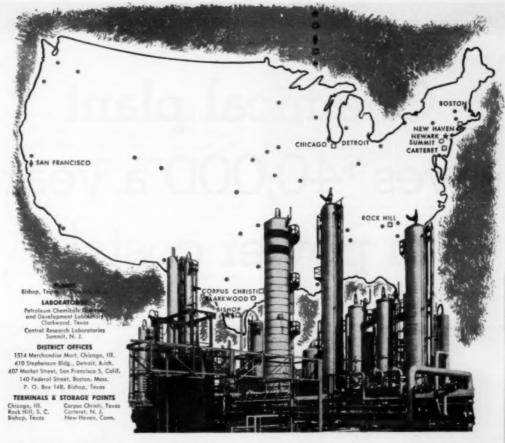
CONCENTRATION FOR DISPOSAL of voluminous or injurious wastes. Cleaver-Brooks Compression Stills provide an economical means of concentration — meet the problem of handling wastes not disposable through local sewer systems or where stream pollution or expensive hauling, piping or barging are prohibitive.

Cleaver-Brooks Compression Stills are available in standard size units from 75 G.P.H. to 2100 G.P.H., electric or Diesel drive. Larger sizes to fit specific applications can be constructed for field erection. Write for bulletin "Compression Distillation". CLEAVER - BROOKS COMPANY, 331 E. Keefe Avenue, Milwaukee 12, Wisconsin



The merit of compression distillation lies in the efficiency with which latent heat is conmantly being reclaimed and utilized — recycling through the evaporator.





## IS AT YOUR FRONT DOOR

Each year, an increasing number of industries look to Celanese for their volume organic chemicals. The modern Celanese plant—incorporating the most advanced equipment and processes—offers a five-fold chemical service that includes:

- · Organic chemicals in dependable volume supply
- A nationwide distribution service
- Bulk storage facilities at strategic locations
- Research that parallels your interests
- Technical service and guidance

The greater part of all Celanese\* chemicals are produced by oxidation of petroleum natural gases. The Celanese Chemcel plant, near Bishop, Texas, is located in the heart of abundant raw material supplies . . . assures a continuity of production.

Celanese laboratories, with a background of a generation of research in petroleum chemistry, are ready to give valuable technical assistance and development help. Write now, for brochure.

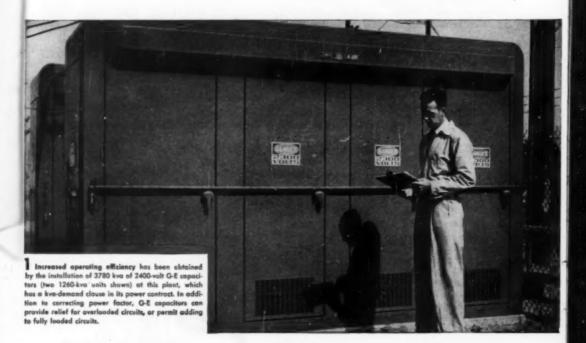
Celanese Corporation of America, Chemical Division, Dept. 503-A, 180 Madison Ave., New York 16, N.Y.



FRen II S Res CM

FORMALDEHYDE . PARAFORMALDEHYDE . ACETIC ACID . ACETALDEHYDE . ACETONE . METHANOL . PROPANOL METHYLAL . PROPYLENE GLYCOL . DI-PROPYLENE GLYCOL . PROPYLENE OXIDE . BUTYL ALCOHOLS . TRICRESYL PHOSPHATE

# Chemical plant saves \$40,000 a year in power costs!



GENERAL BELECTRIC

#### G-E capacitors—recently installed in large West Coast chemical plant—yield an estimated 50% annual return, increase efficiency of plant's power distribution system!

Savings realized by this company are just one example of the deep cuts that G-E capacitors can make in your chemical-plant power costs. Less dramatic, but vital to continuous production, is uninterrupted power supply. It's provided by reliable G-E power distribution equipment and co-ordinated to your individual needs by experienced G-E application engineers. For the whole story of the savings it makes possible, check your local G-E office—soon. Apparatus Department, General Electric Company, Schenectady 5, New York.



2 Incoming utility power is stepped down at these 4 G-E 5000-kva transformers from 112 kv to 22 kv for primary distribution throughout the plant. G-E transformers are available in all kva ratings and voltages to meet a wide variety of chemical-plant needs.



3 For continuity of power to vital loads, the plant uses a secondary selective system utilizing a 7500-kva 22,000/2400-volt G-E double-ended unit substation. Indoor portion shown is G-E metal-clad switchgear, a compact, assembled unit that saves installation costs.



4 Power lesses are cut by G-E unit substations in load center systems. Shown here is the outdoor portion (two G-E 3730-kva transformers) of the plant's G-E unit substation that supplies power to miscellaneous compressor and meter loads located throughout the plant.



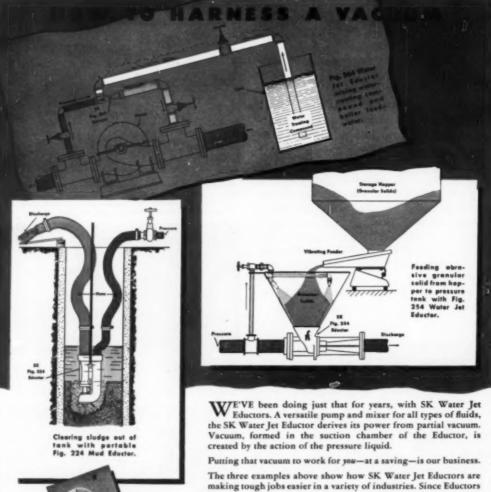
5 Conversion from a-c to d-c for electralytic processes is provided by these two G-E ignitron rectifiers, high in conversion efficiency, rated 3000 kw, 650 volts, 5000 amperes. Their central cubicles are shown in right foreground, and their anode circuit breakers in left background.



Centralized central for the G-E ignitron rectifiers is obtained by means of this G-E switchgear and metering panel, where operator controls primary and rectifier breakers, and in addition obtains all necessary overcurrent relay, load current, and voltage indication.



for Chemical Plants



New Bulletin 2-M describes all types of Water Jet Eductors, with specifications and applications. Write today for your copy. making tough jobs easier in a variety of industries. Since Eductors have no moving parts, maintenance and operating costs are extremely low. And their reliability makes SK Water Jet Eductors ideal for minimum supervision in hard-to-reach installations.

SK engineering can tailor a standard or special Water Jet Eductor to your problem. Mixing, blending and pumping of liquids, gases, slurries or solids—creating vacuum or pressure—are all within our scope. And SK manufacturing can provide a Water Jet Eductor in the size and material you require.

New Bulletin 2-M describes SK Water Jet Eductors, from specifications to applications. Write today for your free copy, or for SK engineering assistance on special problems.



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Louis 3, Missouri

# BAKER PLATINUM BAKER LABORATORY WARE



reacting sets could be applied to any their those to which our platinum labsure is subjected. The tests are contintioning the maintain and operate large scientific borrories and naturally employ our own laboratory ware in them.

The consequence is that any divergence from our high standards, any defect in manufacture, would show up inevitably.

All this makes it doubly safe for you to adopt Baker Laboratory Ware as standard equipment. You can't possibly go wrong in choosing it.

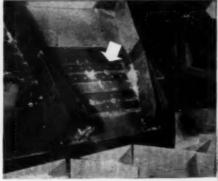
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SPAGHETTI MAKER SAVES \$80.00 PER WEEK with two Dings 4-pale Permo-Plate Magnets to catch tramp iron fermerly removed by hand. Magnets also remove iron of abrasion that fermerly was not removed.





RESPING IRON OUT
OF CANDY BARS
WITH & FRANCE PLANT

REEPING IRON OUT OF CANDY BARS with a Ferma-Plate installed in chuse to remove fine iron from chocolate in liquid ferm.





PREVENTING IRON DAMAGE TO GARNETT BOLLS in a bedding plant with a Dings Permo-Plats Magnet installed allows the spiked agran feeder.

IF you would do away with all types of stray iron — nails, nuts, bolts, wire, etc., and its effects, whether it be product contamination . . . damage to machinery . . . or fires and explosions caused by stray iron sparks — CALL FOR THE DINGS PERMA-PLATE. A look at its report card tells why:

NON-ELECTRIC, PERMANENT. No power costs, no electrical maintenance or accessories.

POWERFUL, POSITIVE. There are 50 years of magnet design experience behind the Perma-Plate.

MAGNETIC PERMANENCE QUARANTEED. Your assurance of magnetic protection always.

MANDLES SOLIDS OR LIQUIDS, HOT OR COLD.

Easily installed anywhere, the Perma-Plate is available in 228 different size and strength combinations to provide you with exactly the right magnet for the job.

#### Send for CATALOG C-1205-A

The Modern, Low Cost Way To Remove Stray Iron

Complete Details on the Permo-Plate Including Sizes and Prices. ASK FOR THE PERMA-PLATE CATALOG.





#### DINGS MAGNETIC SEPARATOR CO.

4730 W. Electric Ave., Milwaukee 46, Wis.

World's Largest Exclusive Buildors of Electric and Non-Electric Magnetic Separators for All Industry



#### FOR YOUR INFORMATION

Every month Measures publishes these pages of pertinent information. Here you will find suggestions and application ideas selected to help you improve your products, lower your production costs, increase your sales. Here information will be fernished on request.

## NEW - Nonflammable hydraulic fluid

#### Monsanto Pydraul F-9 has high lubricity and excellent pumping characteristics

Greater safety for employees . . . longer service and efficiency from machines . . . economy in operation. Those are the advantages offered to industry through the use of Monsanto's new hydraulic fluid, Pydraul \*F-9. Pydraul F-9 is known as Hydraulic Fluid F-9 to industries which have tested and are using the product.

Pydraul F-9 is a nonflammable fluid developed primarily for use in die-casting machines, hydroelectric turbines, glass drawing machines, hydraulic presses and other equipment that requires a fluid power-transfer medium.

Safety, the major advantage of Pydraul F-9, comes from its nonflammability. This characteristic eliminates the fire hazard of ordinary hydraulic fluids, protecting workmen, machinery and buildings.

Economies come from the use of Pydraul



SAFETY, ECONOMY, EFFICIENCY

These are the results of using Monsonto Pydraul
F-9 in equipment requiring a fluid
power-transfer medium.

F-9 because of its high lubricity, its high resistance to shear and mechanical breakdown, and because it does not corrode metals ordinarily used in machines employing hydraulic pressure. These quali-

#### Monsanto Pydraul F-9 resists shear and mechanical breakdown

ties mean longer life for the fluid and less maintenance on machines.

The efficiency of Pydraul F-9 has been proved in the laboratory and in actual service.

Look into the safety, economy and efficiency offered by Monsanto Pydraul F-9, You can get complete details by contacting any Monsanto Sales Office, or by mailing the coupon for a copy of Monsanto Technical Bulletin No. O-D-602.

The technical bulletin gives the physical and chemical properties, corrosion and oxidation stability, four ball-wear tests, effect on elastomeric materials, lubricity tests, and a series of tests which prove the nonflammability of Pydraul F-9.

Monsanto Pydraul F-9 now is available in commercial quantities.

#### Research Chemists' Corner

#### **NEW PRODUCT**

BIS-(4-CHLORO-3-HITROPHENYL) SULFONE

FORMULA — Mol. Wt. C<sub>12</sub>H<sub>2</sub>O<sub>2</sub>N<sub>2</sub>Cl<sub>2</sub>S = 377.24

NO<sub>2</sub>

NO<sub>2</sub>

NO<sub>2</sub>

CI

ASSAY—102% (Dumos nitrogen).
PHYSICAL PROPERTIES — Form: Cream-colored powder, Melting Point; 193-198°.

CNEMICAL PROPERTIES—Labile chlorine atom can be raplaced by amimo, hydroxyl, methoxyl, and anillino groups. Reactions with substituted diphenylamines lead to formation of acid wood dyes. Additional nitro groups can be introduced by treatment with KNO<sub>3</sub> and H<sub>2</sub>SO<sub>6</sub>. SUGGESTED USES — Dyesteff informediate. Organic synthesis informediate.

TOXICITY—Not grossly toxic and only mildly irritating to skin.

AVAILABILITY—Research quantities.





This 16-page booklet gives specifications of 30 Monsanto Chemicals that appear to have possibilities beyond their present uses. Use the coupon to obtain your free copy. If you find new uses for any of the chemicals, you can be sure of ample supply for they now are in commercial-quantity production.

#### Monsanto Intermediates

In Monsanto's extensive family of intermediates are the following that can be shipped immediately. If you have need for any of these, place your order with the Monsanto Sales Office that serves you.

Meta-Nitrochlorobenzene Ortho-Aminobiphenyl Monsanto Salt (Sodium ortho-Chloro-paras folucnesulfonate) Tolucnesulfonic Acid

These Monsanto Intermediates may or may not be available. For information on their availability, contact the nearest Monsanto Sales Office.

Benzyl Chloride
Benzoic Acid,
Technical
Cyclohexylamine
Dieyclohexylamine
Dinitroaniline
Dinitroaniline
Dinitrochlorobenzene
Ortho-NitrochloroSalicylic Acid,
Technical

#### Two chemicals that serve the paper industry

Santosite\* and Santobrite\* are two Monsanto Chemicals that have proved themselves of great importance in the manufacture of paper.

Santosite (sodium sulfite anhydrous, technical) is employed in semichemical pulping, making it possible to pulp hardwoods, straw, cornstalks and agricultural residues. Mild-acting Santosite separates the lignin, the fiber of short-fibered hardwoods and other materials, without degrading the cellulose.

Santobrite (sodium pentachlorophenate, technical) has proved its effectiveness against microorganisms that plague the pulp and paper industry. It controls organisms that cause stain and decay in pulp logs, that degrade pulp lap, that spoil pulp stock. In the water supply, Santobrite controls slime. It prevents decay of felts. Spoilage of coating and sizing materials and mildew on finished products are prevented by Santobrite applications.

Santobrite is chemically stable, noncorrosive to metals, nonvolatile and practically odorless. Santobrite requires no expensive equipment in its application. When properly handled, Santobrite is not hazardous to mill operators.

Available literature: Technical Bulletin No. O-5, "Santobrite for Microorganism Control in the Pulp and Paper Industry"; booklet, "Santosite, the Milder Pulping Agent."

## Sterox CD...a powerful nonionic detergent that gives you "controlled sudsing"

If you have a job for an efficient, lowsudsing detergent and wetting agent in your compound, Monsanto Sterox\* CD is the product you need.

Low-sudsing, 100%-active Sterox CD is high in detersive efficiency over a wide range of concentrations and temperatures. It is effective in hard or soft water . . . over the entire pH range. Used in hard water, Sterox CD does not form insoluble soap scums which are detrimental in many industrial applications.

Nonionic Sterox CD blends easily and efficiently with anionic detergents and soaps . . . with cationic detergents . . . with alkaline "builders" such as phosphates, silicates and carbonates. Its effi-

ciency is stepped up when compounded with "builders." Sterox CD also is used effectively with acid-type cleaners.

Sterox CD may be used wherever controlled sudsing is desired, for control of dusting, and in the following: laundry compounds . . . dishwashing compounds . . metal cleaning and treating compounds . . paint and wall cleaners . . . textile processing compounds . . paste cleaners . . . barrier creams . . . floor cleaners . . . detergents for sanitation . . . liquid cletergents.

For complete information on Monsanto's Sterox CD, mail the coupon for Monsanto Technical Bulletin No. P-129.

#### If plasticizers are hard to get, here's economical way to make them go farther

You can extend your primary plasticizers economically and still maintain your high quality by using Monsanto HB-40 (partially hydrogenated terphenyl) in vinyls, styrene dispensions and casting resins.

As much as 25% of low-coat HB-40, based on the weight of the plasticizers, can be used to extend higher-priced plasticizers in many vinyl formulations. In some styrene dispersions, HB-40 is the only plasticizer needed.

Monsanto's improved HB-40 is practically water white, making it an excellent extender for use in products that are clear or brightly colored. Properly stabilized clear and tinted vinyls, in which HB-40 serves as the extender plasticizer, have good light and heat stability. HB-40 is relatively nonmigratory and is considered very low in toxicity.

For complete information on the application of HB-40, mail the coupon or contact the nearest Monsanto Sales Office.

MONSANTO CHEMICAL COMPANY, 1702-A South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS PLASTICS

SERVING INDUSTRY ... WHICH SERVES MANKIND

## Santomerse No. 1, Monsanto's all-purpose detergent and wetting agent, has many industrial uses

In industrial applications requiring cleaning, wetting out, penetrating or emulsifying, Monsanto Santomerse \* No. 1 is both highly effective and economical.

Santomerse No. 1 may be used in cleaning compounds that are strongly alkaline or highly acid. In prepared alkaline cleaners, the incorporation of Santomerse No. 1 in the compound promotes rapid emulaification of oil films, uniform penetration and quick drain-off. In acid baths for cleaning, treating or pickling metal, small amounts of Santomerse No. 1 will improve the operation of the bath and raise the quality of the work.

A combination of Santomerse No. 1 and Monsanto Tetrasodium Pyrophosphate makes an outstanding compound for commercial wet-process cleaning of wool rugs. In this application, Santomerse No. 1 delivers thorough penetration, removes deeply imbedded soil and brightens colors without damage to the wool. Because of its free-rinsing properties, it is easy to remove the Santomerse No. 1.

For more details on these and many other industrial applications of Monsanto Santomerse No. 1, mail the coupon for a copy of the booklet: "Santomerse No. 1 . . , all-purpose detergent and wetting agent."

SEND INFORMATION:  H8-40  Bis-(4-Chioro-3-Nitrophenyl) Sulfone	MONSANTO CHEMICAL COMPANY 1702-A South Second Street, St, Louis 4, Missouri Please send, without cost or obligation, Iriems indicated at the left.
SEND LITERATURE:    Pydroul F-9   30 Monsanto Chemicals   Santobrite   Santosite   Sterox CD (No. P-129)   Santomerse No. 1	Name

# EVILLE IL SI-767

# SHINGLE STAIN OIL

is a new improved shingle stain oil which will give you a better pigmented or non-pigmented oil at less cost, because it has a mild odor, good penetration and is uniform. In addition, because of its light color you can easily formulate colored oils economically. Such properly pigmented oils will show no rub-off.

> Readily available at 15¢ gallon in tankcars and 25¢ gallon non-returnable drums F.O.B. Neville Island, Pa.

## THE NEVILLE COMPANY

PITTSBURGH 25, PA.

Plants at Neville Island, Pa. and Los Angeles, Calif.

RESINS COUMARONE-INDENE - MODIFIED COUMARONE- INDENE - PETROLEUM - ALKYLATED PHENOLS ONLS SHINGLE STAIN . NEUTRAL . PLASTICIZING . RUBBER RECLAIMING . CREOSOTE SOLVENTS 2-50-W HI-FLASH . CRUDE & REFINED COAL-TAR . WIRE ENAMEL THINNERS SPECIALTIES PHENOTHIAZINE - RUBBER COMPOUNDING MATERIALS - TAR PAINTS

LIGHT

MILD



1621—Glass was money! America's first glass factory was actually a mint—not for the manufacture of coins but to make glass beads for use as money when buying land, food and furs from the Indians.



2 1827—Blown glass was the rule until Enoch Robinson, a carpenter, figured glass could be pressed into shape . . . the glass pressing machine was born. Electricity to power new machines was still to come.



21699.—Owens invented a machine to make bottles as the machine age arrived in glass. By 1915, Howell "Red Band" Motors were making important contributions to this and other industries.

ANOTHER HOWELL SUCCESS STORY

#### GLASS...from artisans to automatic machines



4 Today—Modern, electrically driven machines have im-proved quality, cut costs and increased output in the glass making industry. For example, this unique glass beveling machine, equipped with 7 dynamically balanced Howell Motors, automatically bevels glass at the rate of 2,000 inches per hour! You'll also find precision-built Howell Industrial Type Motors powering bottle and bulb machines, conveyors, grinders, polishers, plate and window machines in the glass industry. Elsewhere, Howell's wide range of standard NEMA motors, and special motors designed to customer requirements, serve dependably and efficiently under the toughest conditions.

For a really profitable investment, buy HOWELL!

Free enterprise encourages mass production, supplies more jobs - provides more goods for more people at less cost.

Howell totally enclosed, fan-cooled motor—windings completely sealed against dirt and weather.



CHEMICAL ENGINEERING-January 1951

## **HOWELL MOTORS**

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built Industrial Motors Since 1915





#### pical Applications in which Ampeo Alloys have been used with Cost-Saving Success!

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Mixers
Mixers
Pona, evaporator

Pickling bus
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Pressure ver
Pumps
Reboilers
Retoris
Rivets
Safety tools Screens
Screens, conveyor
Sludge burners
Springs
Bulls Studs
Sucker red
Teaks
Tools, safety
Towers
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Vats Valves
Wolding rod
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Woven wire cisth

#### Alloys Chemical Agents and the Applicability of AMPCO

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	Benzene or Benzul	
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	Calcium Bisulline	
	Calcium Hydroxide	
	Culcium Hypochiarita	
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Acetate Solvents (Pure) Crude

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Glycarine Gases
Hydrocathen Gases
Hydrocathen Gases
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(see Muriotic)
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Hydrocyanic Acid
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Hydrocathen

Hydrogen Sullide
Wet
Dry
Location and Locquer
Location and Locquer
Location Acid
Magnesium Chloride
Magnesium Bydrazide
Magnesium Bullote
Mail Severoges
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Mine Water (Bullate)
Malinesse
Mencuric Chieside
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Mirica Miric HUGHHUMMUN GHENGREEN **Вимимими** Glaie' Acid
Orygen
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(Escept Seya-Oil)
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Petrolism Oils Sour
Phesphoric Acid
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(except Nitric Chris
Potassium Chloride
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Potassium Hydroxide
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Beelins
Beelins
Sodium Carboeate
Sodium Bicarbonate
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Sodium Carbonate
Sodium Carbonate
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Sodium Carbonate
Sodium Cyanide
Sodium Mitrate
Sodium Mitrate
Sodium Perborate
Sodium Perborate
Sodium Perborate
Alkoline
Neutral
Acid
Sodium Bilicarte
Sodium Bilicarte 

GE

MMDC

Potash Crude

NR F

Toluene or Toluel
Tri Chlorethyleus
Tri Sedium Phosphule
Turpentime
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These retires may EEE GEERHREGHT These ratings may usually be interpreted as follows: HHGH

be interpreted as follows:

E — Excellest

IPY Penaturities

< \$.0.08"

F — Foil:

IPY Penaturities

< 0.030"

NE — Not Recommended

IPY Penaturities

Over 0.050"

In using this date, it should be understood that these are results of specific tests and are indicative of these counters and are indicative of these counters of specific tests and are indicative of these counters are the sets and are indicative of these counters are the sets and are indicative of these counters are the sets and are indicative of these counters are the sets and are indicative of these counters are the sets and are indicative of these counters are the sets a

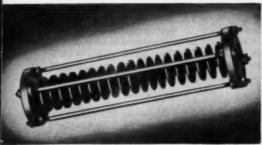
## AMPCO.

# Your Corroscon Phoblems ... use Ampco Alloys

... these unique properties have proved to be the best answer to many process equipment problems



Ampce Centrifugal Pumps — Here—for the first time in pump manufacturing history — is a "production-bullt" and "production-priced" pump to handle acide, altalies, and other corrosive segents hitherte requiring specially built pumps. The Ampce single-stage, single-saction centrifugal pump offers long life, high efficiency and low maintenance costs through the cembination of correct design and properly selected materials.



CORROSION TESTING—Types of Test Specimens — A complete stock of test specimens of a wide variety of materials is kept ready for mounting on racks. Several forms of racks are available for tests in a temospheric locations, pipe lines, tanks or other pressure vessels. When requesting test specimens please outline conditions under which test is to be conducted so that we may supply the most suitable form.

- L High resistance to corrosion
- 2. High tensile strength
- 3. High physicals at extreme temperatures
- 4. High strength to weight ratio
- 5. High impact and fatigue values
- High wear-resistance to erosion corrosion — cavitation, etc.
- 7. High compressive strength
- 8. High modulus of elasticity

Designers and plant engineers in the process industries are turning to Ampco Alloys more and more frequently — because of the outstanding savings offered by their long-lasting qualities.

Costs are reduced in three ways: 1. Minimum down time, 2. Minimum product loss from parts failure, and 3. Minimum maintenance and replacement expense.

Study the list of time-proven applications and the Ampco applicability chart and apply this data to your own needs. Plan your own economies now by specifying Ampco Bronze Alloys for corrosive and erosive media handling. Write today for recommendations and complete information.



Ampco aluminum bronses are available in a number of grades to meet your exact requirements in any form you need: rolled sheet or plate, sand or cantrifugal castings, forgings or extrusions . . . pipe and fittings. Also, Ampco's arc-welding electrodes, corrosion-resistant centrifugal pumps and plug valves.



Ampco Metal, Inc.

Milwaukee 46, Wisconsin

West Coast Plant Burbank, California

#### Free . . .

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Process Industries Bulletin — 16 pages of money-saving informa.

Ampco Metal, Inc., Dept. CE-11, Milwaukee 46, Wis.

Send me your free bulletin, giving full information on the application of Ampro Alloys in the Process Industries.

the application of Ampeo Alloys in the Process Industries

Company Address.

....(.....) State...



## The Brewers uncovered a new wrinkle in an old, old science

THE ancient amber brew, you might call it. Brewing was a familiar art at least 5500 years ago by archeological record, and probably for many centuries before that.

In such a dynasty, the brewers naturally have run the gamut of materials for their equipment. Starting with the sun-baked clay of the ancients, ranging through wood and various metals, today the emphasis is increasingly on stainless steel in the never-ending search for higher quality and purity, finer taste and flavor, and lower overall costs. The bright, shining face of Allegheny Metal is to be found in equipment from one end of a modern brewery to the other, in the barrels on the trucks and in almost every tap-room.

The reason why is easy. No other available metal is at once as strong and as resistant to corrosion, heat and wear as stainless steel. That's why Allegheny Metal is an essential material for so many industrial purposes—and for fighting equipment, too. We're steadily increasing our production, continuing to spend millions in the process—and as a further measure to spread the supply of stainless steel, we offer every assistance to users to avoid undue wastage and spoilage.

Complete technical and fabricating data—engineering help, too—are yours for the asking from Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. . . . the nation's leading producer of stainless steel in all forms. Branch Offices are located in principal cities, coast to coast, and Warehouse Stocks of Allegheny Stainless Steel are carried by all Joseph T. Ryerson & Son, Inc. plants.

You can make it BETTER with Allegheny Metal



WED 11

THE GREATEST VALVE ADVANCEMENT IN YEARS



LIFT-PLUG VALVES Plog Actuator which lifts, turns and resents plug in only three-quarters of a turn of the operating wrench.

The renewable seat, which is not attached to the body, eliminates distortion problems, permits any desired trim and simplifies repair without removal from line.

trim and simplifies r without removal from

IDEAL FOR

Chemical Plant Service

CHLORINE

HYDROFLUORIC ACID

VCAUSTIC VSTEAM DOCTOR SOLUTION

VSULPHURIC ACID

AND OTHER CORROSIVE PRODUCTS

NON-LUBRICATED—no grease of any kind required to effect a seal; prevents contamination of line products; and reduces chance for human error and need for maintenance.

PRESSURE SEALING—when plug is seated, line pressure automatically forces seat into tighter engagement with plug—body distortions do not affect the seal.

UNIQUE LIFT-PLUG ACTUATOR — a novel mechanical design which lifts, turns and reseats plug in continuous turn of a lever.

 RENEWABLE SEAT AND PLUG—easily replaced; permits any desired trim for specific services.

-

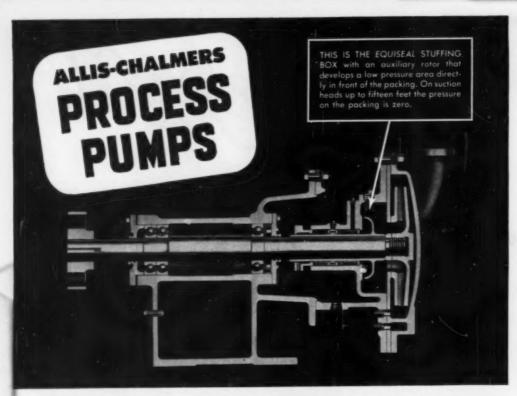
REPAIRS ON THE JOB—can be completely overhauled without removal from line; no special tools or skill required.

EASY OPERATION—requires less operating effort than other valve designs.

FORGED STEEL—all parts, including body for most sizes, are press or drop forged from specification materials.

Cameron IRON WORKS, INC.

P. O. BOX 1212 HOUSTON, TEXAS EXPORT: 74 TRINITY PLACE, NEW YORK, N. Y.



## NEW <u>EQUISEAL</u> STUFFING BOX **Stops Leakage**

IF YOU MUST STOP PUMP LEARAGE because of sanitation, corrosion or for any other reason, you can stop all leakage for suction heads up to fifteen feet by using the Allis-Chalmers Process Pump with the Equiseal stuffing box.

With this pump, maximum pressure on the packing is limited to suction conditions. When suction head is negative, leakage is no problem. When suction head is positive, however, packing pressure requires extra control to prevent leakage. This extra control is the Equiseal stuffing box with an auxiliary rotor that develops a low pressure area directly in front of the stuff-

ing box. Pressure on the packing is zero for suction heads up to fifteen feet.

The Equiseal stuffing box is so effective that the packing can be removed while the pump is operating on positive suction head and there will be no leakage even though there is a direct passage from pump suction to atmosphere. The Equiseal stuffing box can be added to your present Allis-Chalmers Process Pumps.

If you pump corrosives or abrasives, you should know about the Equised stuffing box. Ask your Allis-Chalmers Sales Office or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 08B6615. 2207

Sold . . .

Applied . . .

Serviced . . .

by Allis-Chalmers Authorized Dealers, Cartified Service Shops and Sales Offices throughout the country.



MOTORS - 1/2 to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete con-





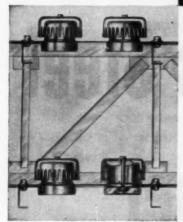
TEXROPE — Beits in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

Equippel, Taxrana and Vari-Pitch are Allis-Chalmers trademarks,

## **ALLIS-CHALMERS**

## "the last word" in bubble tray improvements

## Gilbarco LIGHTWEIGHT ALLOY BUBBLE TRAYS



NEW CAP ASSEMBLIES — New design makes possible quick, easy removal by one man, working from top side. Flush tray surface, without flanges and projecting edges around holes, makes cleaning faster and easier.

#### NEW BRIDGE-TYPE TRUSS DESIGN

One truss for every two trays when long spans are necessary . . . with every alternate tray level free of major supports. Gilbarco Duo-Level Alloy Bubble Trays are faster to install, far easier of access, more rigid with lighter weight.



NEW CLAMP DESIGN — Decreases joint leakage with minimum amount of packing.

AS NEW EQUIPMENT OR REPLACEMENTS — Gilbarco's large staff of engineers is at your service to demonstrate how Gilbarco Bubble Trays can be fabricated to meet the requirements of your process design.



What YOU can do to make the supply of Stainless Steel go further



Tell your supplier the exact purpose
the Stainless Steel is intended for and
how you plan to fabricate it. Then you
will get the right steel for the job.

Minimize your scrap losses by ordering the sizes that will cut to best advantage.

Indicate, if possible, acceptable alternates in composition, gage, size and finish . . . it may speed up deliveries to you.

These suggestions for conserving Stainless Steel are made to assist you during the difficult period we face today. The withdrawal of large tonnages of Stainless Steel—vital for rearmament—make it imperative that supplies of Stainless available for non-military use be made to go as far as possible. This can't be done without the close cooperation of everyone concerned—the steel producer, the steel supplier, and you, the steel user.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND . COLUMBIA STEEL COMPANY, SAN FRANCISCO
HATIONAL TUDE COMPANY, PITTSBURGH . TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM . UNITED STATES STEEL COMPANY, PITTSBURGH
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### U·S·S STAINLESS STEEL

SHEETS . STRIP . PLATES . BARS . BILLETS . PIPE . TUBES . WIRE . SPECIAL SECTIONS

UNITED STATES STEEL

# 3 steps to successful

### ION EXCHANGE PERFORMANCE

Whether it is a simple greensand softener or a large demineralizing plant, these three essential steps are necessary to produce an ion exchange installation which:

- · is easy to operate
- requires low chemical regenerating costs
- yields uniformly dependable performance



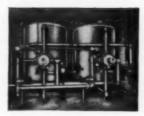
#### LABORATORY RESEARCH

Graver chemists and technologists are continually evaluating the performance of many ion exchangers to determine the optimum operating conditions for each. As a result of this work the specific advantages of more than forty available Graver ion exchangers can be effectively applied to a wide range of processes.



#### PILOT PLANT OPERATION

Graver development engineers regularly conduct tests on small scale pilot units operating under simulated plant conditions. These tests serve to check laboratory experiments and to work out problems in mechanical design. This assures dependable operation of the ion exchange equipment under actual service.



#### COMMERCIAL EXPERIENCE

A background of thirty years' successful commercial experience is reflected in the design of Graver equipment. Graver chemical engineers have pioneered the commercial application of many new ion exchange processes. Dependable service is assured as a result of this experience.



"Operating experience with Resin Zeolites on the Hydrogen Cycle"

"Present Practices in the Use of Ion Enchangers in Weiter Treatment"

"Silica Removal by a Fractical Ion Exchange Process"



#### GRAVER WATER CONDITIONING CO.

216 West 14th Street, New York 11, New York, U.S.A.

GW-423

DIVISION OF GRAVER TANK & MFG. CO. INC. EAST CHICAGO, IND

Choosing tower packing for efficiency and long life...

With critical shortages imminent in almost every heavy industry, the question of what tower packing material to use warrants the most careful forethought.

To the requirement of optimum performance now must be added durability...replacements may be hard to make in the years ahead.

The various tower packing forms developed from Nickel, Inconel® and Monel® deserve your special consideration. All three metals possess high strength, wettability, and high resistance to attack by many fluids processed in packed towers.

Metal tower packing offers five basic advantages that serve to increase tower efficiency: Low weight per unit volume.

- Large surface per unit volume.
- Large percentage of open area.
- Small weight of liquid retained.
- 5. Corrosion resistance.

If you need help in selecting a satisfactory metal tower packing material, Inco's Technical Service Department will gladly make recommendations. Simply write, outlining your problems.

THE INTERNATIONAL HICKEL COMPANY, INC. 67 Wall Street, New York 5, N. Y.

Berl suddle type tower packing, produced in Inco Nickel Alloys and other metals, supplied by Wire Cloth Products, Inc., Chicago, Ill. Packing of this type has given excellent results in pilot rowers. It compares favorably in cost with other forms of packing.

\* \* \*

Although Nickel and Nickel Alleys are currently in short supply, INCO advertisements will continue to bring you news of new products, applications, and technical developments.

\* \* \*

Diagram of protruded potking made by Scientific Development Company, State College, Pa. The individual pieces are small, yet have a large free cross-section. Made in Nickel, Type 316 Stainless Steel, and other metals (on special order).

NICKEL ALLOYS

MONEL® • "R"® MONEL • "R"® MONEL • "R"® MONEL • "S"® MONEL • "S" ® MONEL • "S"

Heart of a fractional liquid extraction unit comprising a mixing and settling section. The settling section is packed with knit tower packing, open areas from 90% to 98% are obtained, with surface areas up to 200 square feet per cubic foot of packing. Courtesy Otto H. York Co., Inc., East Orange, N. J.



Nearly three tons of Raschig sings, ready for shipment to a large chemical manufacturer. Made of Nickel strip 1½ inches wide by 0.050 inches thick, by the Metal!o Gasket Company, New Brunswick, N. J.





It's worth checking into — one of the many Tygon Plastic formulations may be the answer to your touch corrosion problems.



MOLDED TYGON
Gaskets, gromoets
disphragms, molded
mechanical items

cultiv applied costing, as protection against corrosive fames. Where flexibility, clearness, and freedom from toxicity is a must in fluid transmission — there's only one answer, TYGON plastic TUBING.

Tygon Tubing is tough as leather, flexible as a piece of string, clear as glass. It neither imparts nor absorbs taste or odor. Resistant to acids, alkalies, oils, water, alcohols. Mirror-smooth surface inside and out speeds flow; makes cleaning easy. Tygon Tubing can be steam sterilized.

Tygon Tubing is made in bores in standard or special sizes up to 2" ID, and is available with an outer braid-reinforcement for pressure applications.

Bulletin T-77 contains complete technical information. Free on request. Write for it today. Address The U. S. Stoneware Co., Tallmadge Square, Akron 9, Ohio.

MANUFACTURERS AND FABRICATORS OF CORROSION RESISTANT MATERIALS AND EQUIPMENT SINCE 1865

# THE Chementator

#### COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

#### Toward a hydrogen bomb

As the world situation worsens, a chain reaction of atomic developments is being touched off. These are the developments:

Du Pont is to build a \$260 million plant for AEC in South Carolina. Its likely purpose: bombardment of lithium with neutrons in atomic piles to transmute it into tritium, the extra-heavy hydrogen isotope needed to fuel the H-bomb (for full story, turn to page 181).

Five big utility companies are joining forces to build a \$65 million electric generating plant to supply power for another planned atomic project. The companies are Union Electric Co. of Missouri, Central Illinois Power Service Co., Illinois Power Co., Kentucky Utilities Co. and Middle South Utilities Co.

The power produced by these five companies, together with power from a \$184 million steam-electric plant that TVA is expected to build on the site, will be used at another new AEC plant at the Kentucky Ordnance Works near Paducah. This \$500 million gaseous diffusion plant will produce U-235 for atomic weapons. It will be run by Carbide & Carbon.

A \$5 million chemical processing plant will be built at the Wabash River Ordnance Works in Indiana, with Du Pont in charge of operations. Du Pont will run the \$500,000 plant already completed there and the new plant when it is built.

Phillips Petroleum will operate a new reactor being built on the Snake River Plains west of Idaho Falls. One of three different types of reactors now being constructed on the site, it will test materials for use in future reactors.

Site of the new uranium ore refinery is still hushhush. But Catalytic Construction Co., a Houdry subsidiary, is already surveying uranium refining processes, and will design and engineer the refinery. Its estimated cost: about \$10 million.

#### Cutback in chlorine

National Production Authority was expected to allocate chlorine sold in the open market on January 1. Integrated chlorine producers—those using all they make in their own products—would be exempt. Allocations would mean a cutback of about 10 percent in the amount non-integrated producers could use in civilian products.

#### Synthetic rubber price raised

The government has hiked the price of GR-S from 18.5 c. a lb. to 24.5 c. and the price of butyl to 20.75 c., also from 18.5 c. High cost of alcohol is blamed for the boost in GR-S. The alcohol is needed to make butadiene for manufacture of the GR-S. Rising freight charges are also a factor. The butyl price increase reflects only these and rising operating costs, since no alcohol butadiene goes into butyl.

Next step expected is for the government to take over the buying and selling of all natural rubber, as it did during World War II. Under such a move, the government would be expected to fix the price of natural rubber. It's not unlikely that the government will peg the price of natural at 50 c. to 55 c. a lb.

Meantime, manufacturers have been ordered to cut back the use of natural rubber 30 percent this month and next. They will, however, be allowed to make up the reduction by using more synthetic.

#### Vast titanium venture

VITAL PROJECT—An undertaking of vital economic and strategic significance to the United States is the inauguration of a new process of smelting titanium ore from Canadian deposits that are the largest in the world. At Sorel in Quebec, first of five stationary electric are furnaces, biggest ever with sprung roofs, is now processing titanium ore from an ilmenite deposit of 125 million tons at Lac Tio, Quebec.

This marks the commercial birth of a joint venture in the titanium field costing two U. S. firms well over \$30 million. Quebec Iron & Titanium Corp., which operates the project, is owned two-thirds by Kennecott Copper and one-third by New Jersey Zinc. Fraser-Brace, design engineers and constructors of New York and Montreal, built the 27-mile ore railroad and the smelting plant.

SIGNIFICANCE—With the exploitation of Lac Tio, the United States eventually will not have to depend on overseas sources such as India for titanium-bearing materials. The new processing technique will make more titanium dioxide available for pigment, now heavily in demand, or for transformation into titanium metal, soon to be needed for armament and superalloys. The high-grade melting steel obtained in the (Continued on page 70)

#### THE CHEMENTATOR, continued

electric-furnace smelting will be useful to the Canadian steel economy.

in the summer of 1952, the new treatment plant will handle 550,000 tons of ilmenite ore annually, turning out 200,000 tons a year of high-grade iron and 250,000 tons a year of slag, containing more than 70 percent titanium dioxide. That comes to 190,000 tons of titanium dioxide, or 59 percent more than the present annual output of National Lead at Tahawus, N. Y. What's more, the reserves of the dioxide at Allard Lake exceed those at Tahawus by at least 37 million tons. The Allard Lake capacity also will represent 107 percent of the 1949 U. S. consumption in terms of ore tonnage and 71 percent in terms of titanium dioxide content.

FURNACES—The five furnaces are the first to be used for the large-scale electric smelting of titaniferous ore with the intent of recovering the titanium dioxide. A method, requiring the addition of little or no flux, has been found to produce a marketable melting steel and a titanium-rich slag.

SLAG PROCESSING.—Slag output of the plant will be shipped to titanium pigment producers in the U. S. Four major producers of titanium dioxide pigment in the U. S. are American Cyanamid, Du Pont, Glidden and National Lead. Much of the slag will probably be digested with sulphuric acid and leached. It is expected that nearly 85 percent of the titanium dioxide will be recovered from the leach solution, for this slag has good digesting properties. The iron content of this slag is low, so less sulphuric acid will be required per pound of output compared with titanium concentrates previously processed. The low iron content also eliminates the need of removing iron as ferrous sulphate. Thus time and cost of the digestion process are likewise cut.

percent of the titanium dioxide produced in the U. S. is used as a white pigment. In the future, however, part of the slag output undoubtedly will be diverted to production of titanium metal. With ample low-cost power at Sorel, the possibility of titanium metal production there cannot be discounted.

A bigger output of titanium metal in the U.S. is planned. National Lead has agreed to operate the Boulder City, Nev., pilot plant of the Bureau of Mines, and is contemplating a commercial plant of its own. National Lead has leased an 80-acre tract and seven buildings at the Henderson, Nev., site of Basic Magnesium, Inc., and has contracted with the Colorado River Commission of Nevada for power. A plant to turn out titanium in volume would cost \$15 million to \$20 million; it would require hundreds of millions of kilowatt-hours of power annually. So far, power allocation of 151 million kilowatt-hours has

been obtained. In addition, Du Pont has a new plant on the way. By the middle of this year, total capacity should be 3,000 tons or more.

Titanium metal is, of course, available, but in sponge form it costs \$5 a lb. and in ductile form \$7.50. What's needed is a process that will produce the metal for \$1 a lb. or less.

At least two methods of making the metal are in use. One is the magnesium reduction of titanium tetrachloride in the absence of air at high temperatures. The other is the calcium reduction of titanium dioxide. That's the method Dominion Magnesium, Ltd., in Canada is rumored to be using to make the powdered metal from commercial pigment-grade titanium dioxide. Dominion sells the powdered metal at \$4 a lb., against \$5 in the U. S.

#### Needed: chemical tank cars

Unless they get enough steel, builders of tank cars won't be able to meet even the anticipated minimum needs of the chemical industry for cars in 1951. How to keep the critical steel flowing to the car shops was thrashed out at a recent powwow of spokesmen for the Manufacturing Chemists' Association, tank car builders and National Production Authority officials in Washington.

The car building program gets under way this month. Just for the first quarter of 1951, NPA has tentatively allocated steel for 2,000 cars for the petroleum and chemical industries.

In the shops, the steel scarcity threatens to derail the already slowed building program. Car builders warn it's imperative that NPA get the steel for them. Otherwise, they won't be able to fill order backlogs and keep their chemical car building on the track.

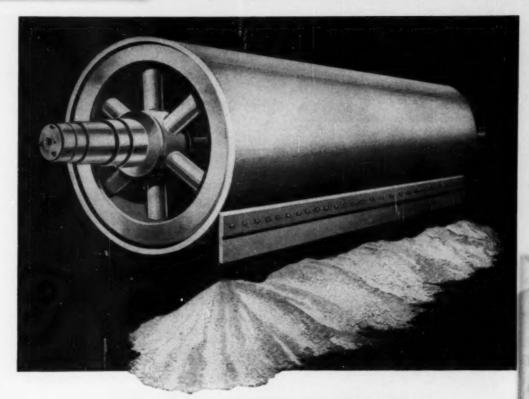
MCA has detailed car types needed to haul critical chemicals. With this information, NPA set up the initial phase of the building program. Commerce Department officials are determined to stick to their plans. To this end, they've asked car builders to submit specific supplemental facts so that NPA can buttress allocation demands.

#### Chemical unions in organization drive

TARGETS—The expanding chemical industries have been raised as prime targets for labor union expansion. AFL, CIO and District 50 of the United Mine Workers have intensified their organizing activities in chemicals.

FUNDS—The AFL Chemical Workers and the CIO Gas, Coke & Chemical Workers recently raised the per capita tax collected from local unions from 75 c. to \$1 a month. Most of the increase is carmarked for organizational activities. District 50's tax remains at \$1.50.

DRIVE—Here's the three-step program the (Continued on page 74)



## Flake Drying Gets a 67% Boost

To increase flaking production, a large eastern chemical manufacturer installed a 60" diameter Lukenweld Jacketed Steel Drier. It replaced one identical in size but of another type of construction. When operated at the same pressure as the one it replaced, the new drier increased production 33%—proof that under identical pressures Lukenweld Jacketed Steel Driers are better heat transfer units. When pressure on the drier was increased, production jumped 67%. Even further increases can be obtained, since the drier is still operating well below the pressure for which it was designed.

Lukenweld machinery, offering predictability,

resistance to shock, high strength, design flexibility and weight savings, not only produces a better product but also amortizes itself in lower production costs. These advantages are the result of Lukenweld's specialized manufacturing and engineering experience combined with practical application. Such know-how—plus Lukens' 140 years of experience in producing specialty steels—is back of every Lukenweld job. Result: maximum quality... maximum investment return.

For information on flaker and other drying and processing machinery for the chemical field, write Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

Improved machinery for improved processes through engineering

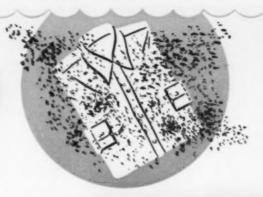
## LUKENWELD





#### PROBLEM ...

... to help manufacturers of "soapless soaps" produce detergents which would wash clothes whiter by preventing the washed-out dirt from being redeposited.



#### SOLUTION ...

... a special grade of cellulose gum, Hercules® CMC-CT. In numerous tests, it was found that a 5% replacement of the active detergent content with noticeable with each washing!

CMC-CT improves soil removal and whiteness retention properties nearly 50% even after five washings. And this greater whiteness is increasingly 80 Photograph shows Baker Terg-O-Tometer used to evaluate whiteness retention of "Hercules" CMC ("CT" grade) in detergents. 70 CMC CONTENT EXPRESSED AS NET CMC BASED ON ACTIVE DETERGENT NUMBER OF WASHES 50

SYNTHETIC RESINS - CELLULOSE PRODUCTS - TERPENE CHEMICALS - ROSIN AND ROSIN DERIVATIVES

% REFLECTANCE (HUNTER)

Detergents represent only one group of products improved at low cost by the addition of small quantities of "Hercules" CMC. Many others, ranging from pharmaceuticals to paperboard, can be made better with cellulose gum.

Purified CMC is unsurpassed among water-soluble colloids for its combination of thickening, suspending, film-forming, and stabilizing properties. In emulsion paints, it controls viscosity and suspends pigments. In textiles, it does a better, faster job in warp sizing; improves textile printing pastes. In the paper industry, it increases the strength of paper and board, improves finish and printability. We would like to tell you more about "Hercules" CMC ("CT" or Purified Grades), and the opportunities its diverse properties offer in developing new products or improving existing ones.

HERCULES POWDER COMPANY 952 Market St., Wilmington, Del.
Sales Offices in Principal Cities

#### RESULT...

. . . detergents which not only get clothes whiter and keep them whiter through many washings, but cost less to make. By reducing the amount of active detergent needed, this grade of CMC permits the generous addition of cheaper alkaline builders.





#### **Brick Defoamer Stops Waste**

Introduced to the paper industry only a few manths ago, "Defoamer 4" in 2½ th. bricks has already gained wide acceptance. Easy to use, easy to handle, it eliminates waste, mess, and drums. One brick dispersed in water makes 40 gallons of defoamer liquid. Send for free sample brick.

#### Versatile Resin Alcohol

Hercules Abitat®, a highly saturated primary alcohol derived from rosin, is finding increased use as an intermediate in the manufacture of oil additives and as a modifier in alkyds. Its viscous balsamic nature and pale color also make it usaful in specialty adhesives and printing links. Send for testing sample.

#### New Water-Base Lacquer

In this recent Hercules development, ethyl cellulose, nitrocellulose, or cellulose acetate are dispersed in an equal weight of water and ground to a particle size of 4-5 microns. Applied to surfaces and heated, the hydrosol dispersions dry and fuse to a continuous film. Modifiers can be added directly to the dispersions. Advantages include the elimination of volatile solvents and an increase in solids content. These dispersions are presently available in research quantities only.

#### **Extends Scarce Phonolics**

In molding materials and many other formulations where dark colors are satisfactory, Vinsol® can replace up to 30% of the phenolic resin—without any appreciable socrifice in physical or chemical properties. Currently priced at less than 5¢ per pound, this dark-colored, high-melting thermoplastic also offers substantial sevings in total resin costs. Send for generous testing sample and specific technical advice.

CHLORINATED PRODUCTS AND OTHER CHEMICAL MATERIALS FOR INDUSTRY HERCULES

#### THE CHEMENTATOR, continued

CIO has laid out: (1) mop up in plants already under contract by signing up the free riders-employees who have not joined the union; (2) complete the unionization of an entire company, where only some of its plants are under contract, by organizing the non-union plants; and (3) push the organization drive westward "to follow the expanding chemical industry and its new adjuncts."

TACTICS-In the West, the CIO's drive will get a boost from the fellow CIO Oil Workers. This union will be most active in organizing chemical plants in and around the oil-producing areas. A plan to merge the CIO's chemical union with its oil workers is being resisted by the smaller union, but it is still a possibility in the next few years. A formal merger proposal was defeated by the chemical workers at their Cleveland convention.

#### Alberta oil reaches U.S.

Crude oil from Canada's Alberta oil fields has started flowing into Superior, Wis., through a new \$90 million pipeline. Most of this oil will eventually move by lake tanker to Canadian refineries in the Sarnia, Ontario, area; but some will be refined at Superior and the products sold in Minnesota, Wisconsin and upper Michigan. One refinery has already been built, and two more are in the works.

#### Latin America needs U.S. know-how

Government and business leaders should make sure the U.S. continues its participation in Latin America's industrialization, despite mounting U.S. military and economic commitments elsewhere due to the taut international situation. So declares Otto F. Sieder, executive vice president and general manager of H. K. Ferguson. He's just back from a swing through South America, where he conferred with top business and government officials.

"Although competition from European countries is becoming increasingly keener," reports Sieder, "South American industrialists are still favoring the United States as their prime source of technical know-how and equipment. This is true in spite of the fact that in many instances European engineers and manufacturers have attempted to regain this market by underselling

American producers."

Sieder spent much of his time in Bogota, Colombia, where Ferguson is engineering and building a new alkali industry. It represents a thumping \$15 million investment. Construction started in 1948, and will continue until 1952. Facilities for the production of soda ash, caustic soda, refined salt, sodium bicarbonate, chlorine and coke are being provided. Sponsor of the project is Instituto de Fomento Industriale, an agency of the Colombian government.

Colombia and other South American republics are

progressing in their programs for basic industrialization, according to Sieder. While few plans are as far advanced as the Colombian alkali project, the potential for future trade between South American industrialists and U.S. suppliers may, in the near future, be an important factor in our economy, he says.

#### Natural gas for Henderson?

Piping natural gas into Henderson, Nev., would give that mushrooming chemical center a big spurt. So far, with the exception of the limited electric power. most of its energy has come from fuel oil. But the advent of natural gas may not be far off. After hearings this spring, it's likely the Federal Power Commission will give Nevada Natural Gas Pipe Line Co. the go-ahead to bring gas into the Henderson-Las Vegas

The company wants to string 114 mi. of 10-in. pipe to tap gas from the 24-in. pipeline of El Paso Natural Gas Co. that extends from New Mexico to Topock, Ariz., where it connects with the Pacific Gas & Electric Co. main transmission line to the San Francisco Bay area. Proposed tap point is at Topock.

Planned capacity of the 10-in. line is 17 million cubic feet per day at the outset of the operation. Most of it is expected to be used in the Henderson-Las Vegas area. But the construction program also calls for a 4in. lateral line to Boulder City, Nev., and a smaller one to Needles, Calif. Rated daily capacities of the Boulder City and Needles pipelines are, respectively, 1.7 million and 1.2 million cubic feet. The entire system will cost an estimated \$2.4 million.

#### Chemicals advance in price

Two important chemicals went up in price as the new year began. The two: ammonia and ethanol.

Ammonia prices were raised by major producers to \$80 a ton from \$74, effective January 1. Companies taking this action include Du Pont, Mathieson, Commercial Solvents and Shell Chemical.

Industrial alcohol was advanced to 90 c. a gal. from previous prices of 65 c. to 70 c., effective on spot orders and on contracts after January 1. Large producers of alcohol are U.S. Industrial Chemicals, Monsanto, Commercial Solvents and Publicker.

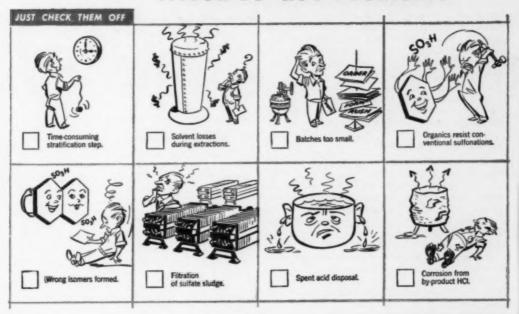
#### More concentrated superphosphate in 1951

Despite an expected cutback in production of concentrated superphosphate by the Tennessee Valley Authority, there will be a substantial increase in the output of this important plant food during 1951. At present, the industry can produce about 750,000 tons per year, including about 150,000 tons that TVA can make. Increases in capacity, now under construction or projected beyond the blueprint stage, are estimated at 875,000 tons.

More and more farmers and fertilizer producers (Continued on page 76)

#### If You SULFONATE

#### ...You've Got Problems



#### If you want to solve them, use SI





General Chemical SULFAN, stabilized sulfuric anhydride, has helped many manufacturers solve their sulfonation problems. Its advantages and economies are evident in producing detergents, dyestuffs, pharmaceuticals, textile wetting agents, organics, plastics and other products.

You may find it has much to offer in your operations too. To study its benefits, draw upon the special application data General Chemical has available for various processes. A confidential letter outlining your special problems will enable us to compile material of greatest immediate value to you. Write today to-

**Product Development Department** 

#### GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION 40 Rector Street, New York 6, N., Y.

Offices in Principal Cities from Coast to Coast

s"Bulfan" in General Chemical's registered trade-mark for liquid sulfur trioxids.

#### THE CHEMENTATOR, continued

are coming to realize the advantage of high-concentration superphosphate, what with freight rates climbing.

TVA makes no secret of its intention to cut back production of concentrated superphosphate, certainly not later than the end of the present fertilizer year, July I next. Greater emphasis is planned on metaphosphate. Also to be increased is output of fused phosphate rock or other rock from which fluorine has been eliminated. The difficulty with fused rock is that no known refractories are satisfactory for the furnaces in which it would be made.

Altogether, it is expected that the TVA output of concentrated "super" in 1951 will be less than half the rated capacity of its plant. And TVA may make none in the second half of the calendar year.

#### Booming nitrogen industry

Expansion of the synthetic nitrogen industry by some 200,000 tons of ammonia capacity since 1945, according to Vice President M. F. Fogler of Allied's Solvay Process Division, is today enabling the industry to meet both peace and preparedness demands.

Use of synthetic nitrogen in industry has about tripled in the past 10 years. During this same period, plant capacity has been increased some 200 percent. Today, total U. S. annual capacity for nitrogen stands at about 1.4 million tons, yielding 1.7 million tons of ammonia. Solvay has expanded the annual capacity of its plants by about 80,000 tons of nitrogen since 1946, says Fogler.

U. S. consumption of nitrogen materials as plant food reached an all-time high of nearly a million net tons, nitrogen equivalent, in 1949. As an indication of this trend toward greater use of nitrogen fertilizers, Fogler cites a 500 percent increase in the consumption of mixed fertilizers in the Midwest alone since 1940. At present North Carolina uses about 10 percent of all the mixed fertilizer consumed in the U.S. As natural plant food resources are depleted, fertilizer demands are expected to follow an increasing upward trend.

In addition to its importance as a plant food, fixed nitrogen is, of course, essential to the nation's defense. As Fogler reminds us, "There is scarcely an important explosive for either peacetime or military use that does not have nitrogen as its vital constituent, the atomic bomb excepted."

#### More synthetic glycerine coming

Shell Chemical will increase output of synthetic glycerine at its Houston, Tex., plant by 50 percent. The added production is to come on stream in increments during 1951.

Chief cause of the present shortage has been the cutback in byproduct glycerine from soap manufacture, due to greater use of synthetic detergents. What's more, civilian and defense requirements for glycerine are climbing.

Shell's synthetic glycerine plant went on stream in 1948 and has since provided a big share of total U.S. production. Some big users of glycerine: alkyds, cellophane and explosives.

#### Plastic film and sheeting zooms

Fastest growing branch of the plastics industry, the film, sheeting and coated fabrics group has expanded from a production of 2,954,047 lb. of vinyl plastics in August 1945 to 22,322,715 lb. in September 1950. During 1946, the first full year for which records were kept, 63,752,707 lb. was produced. For all of 1950, it is estimated that 265,729,219 lb. went into plastic products made from these vinyls.

#### Way to modify cellulose

A method for improving cellulosic materials by treating them with alcohol has been developed by Dr. Richard E. Reeves at the Southern Regional Research Laboratory of the Department of Agriculture in New Orleans. Cellulosic materials, low in viscosity and suited for chemical uses, are especially resistant to reagents, particularly alkalis.

The treatment is alcoholysis or, more specifically, methanolysis or ethanolysis, where the alcohols employed are methanol or ethanol. A cleavage of certain linkages in the cellulose molecule occurs so that a modified cellulose is formed, containing alcohol bound in chemical union so as to stabilize the aldehyde endoroup.

Licenses on this patent, on a royalty-free nonexclusive basis, can be secured from USDA's Bureau of Agricultural & Industrial Chemistry in Washington.

#### Single-stage rocket sets record

A Navy Viking rocket fired at the Army White Sands Proving Grounds, Las Cruces, N.M., recently soared to an altitude of 107 miles, a new record for American-built single-stage rockets.

At the point in its trajectory when its fuel supply of liquid oxygen and ethanol gave out, the 5½-ton 50-ft. rocket was traveling through the upper atmosphere at better than one mile per second.

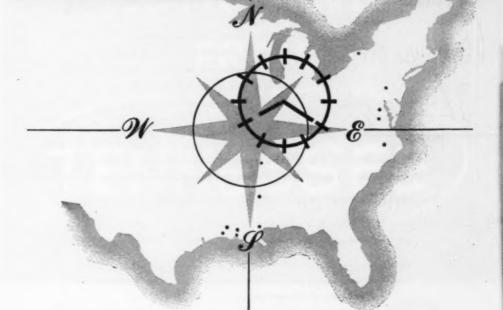
Thirty channels sent continuous automatic signals to the ground station bearing information on the rocket's flight characteristics, motor performance, missile aspect and the upper air.

The Viking is the biggest American-built rocket for upper atmospheric research. It can carry a maximum payload of 1,500 lb., although the record-shattering one carried less than 700 lb. Its engine can develop a thrust of 20,000 lb. for over a minute.

The Viking was designed and developed by the Naval Research Laboratory, the Glenn L. Martin Co. and Reaction Motors, Inc.

-End

# DEPENDABILITY -that delivers heavy chemicals as needed



More than ever before, the new Mathieson signifies dependability to customers. Physically, Mathieson's 14 great plants, strategically located to serve America's chief industrial areas, turn out a wider array of heavy chemicals than any other producer in the country.

In addition, many of Mathieson's basic products can be combined in various ways

to meet shifting market conditions. Equally important to chemical consumers is the type of technical and sales leadership which is constantly enabling Mathieson to raise its standards of service.

As a result, the new Mathieson affords dependability based on capacity to produce, flexibility of production, diversity of products and processes, and high standards of service. Mathieson Chemical

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12 Basic Heavy Chemicals \* 14 Strategically Located Plants

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

CHEMICAL ENGINEERING-January 1951

77

#### HOW VACUUM SAVES 66 hours on a 72-hour job



Vacuum expedites processing, reduces
labor, works at lower temperatures, and often cuts
costs to a fraction of those by other methods. Drying,
impregnating, distilling, sublimation, and metallizing
are a few of the processes for which vacuum is widely used.

Take a single example: the drying of shellac. After months in the making shellac offers stubborn resistance to the drying out

of moisture . . . a 72-hour job by conventional atmospheric methods. Under vacuum, drying is done in a scant 6 hours . . . and the end-product has better physical characteristics.

Three days reduced to 6 hours . . . saving over 90% of the drying time on this process!

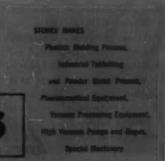
Stokes Vacuum Shelf Dryers, Stokes Condensers, Stokes Vacuum Pumps and Stokes Vacuum

Gages are used for this work at Haeuser Shellac Company, Brooklyn, N.Y.

Stokes Vacuum Engineers—experienced pioneers in Vacuum Engineering—constitute an Advisory Service for you on moisture removal problems

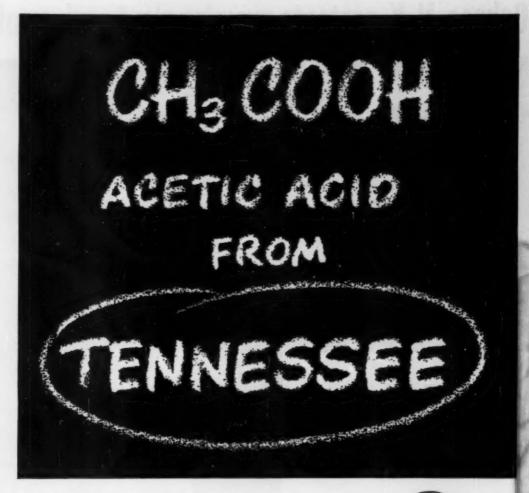
or on any of the other unique possibilities of applied vacuum.

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Then we'll demonstrate for you why particular buyers agree—
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Tennessee can supply your complete requirements. For quotations and product information, write or call



Corporation



#### Cohoes, N. Y. protects pumping plant equipment



G-E Limitamp installed at Cohoes, N. Y. for control of two 500-horsepower maters

Recently, Cohoes installed a new 500-horsepower G-E synchronous motor on a raw water pump. Before they selected control the city engineers wisely decided on a complete study of the power supply. Working with the G-E sales engineer they determined the available short circuit capacity of the system was 60,000 kva. The destructive potentialities of this power obviously called for an "insurance" that would protect their investment.

G-E Limitump was the "insurance". It answered every need. In addition to controlling the motor, its co-ordinated design, using current-limiting EJ-2 fuses, will clear shorts in less than half a cycle—well before damage can occur to motor or control. Extra dividends in the new smaller size, protection to personnel, reduced installation, engineering, and maintenance costs are inherent in this equipment, too.

For your high-voltage installation ask for G-E Limitamp—now available in ratings up to 4800 volts with an interrupting capacity up to 250 kva. Protect your power system and motors with G-E Limitamp—more information in Bulletin GEA-5409. Ask the nearest G-E office for this bulletin or write Section 730-23, Apparatus Dept., General Electric Company, Schenschady, N. Y.

GENERAL



ELECTRIC

# MILESTONES ...in ION EXCHANGE

1912 The Permutit Company was founded to pioneer the application of ion exchange to the treatment of water. This revolutionary process utilized the first synthetic zeolite or ion exchanger, Permutit M, a sodium aluminosilicate.

1918 Permutit developed a process for stabilizing and increasing the capacity of naturally occurring greensand glauconite. This material, sold as Zeo-Dur, is still the best material known for certain applications.

1935 Permutit produced the first commercial organic cation exchanger . . . Zeo-Karb. This material was the first that could be operated on both the sodium and hydrogen cycles.

1937. Permutit manufactured the first resin type ion exchanger, Demineralite, for removing anions from solution. The first commercial demineralizing installation was made employing this material in conjunction with hydrogen regenerated cation exchanger to produce the chemical equivalent of distilled water.

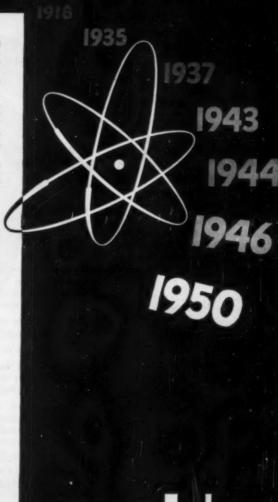
1943 Permutit made the first mixed bed demineralizing unit for the Armed Forces.

1944 Permutit developed and produced for the Armed Forces an ion exchange material for making potable water from seawater.

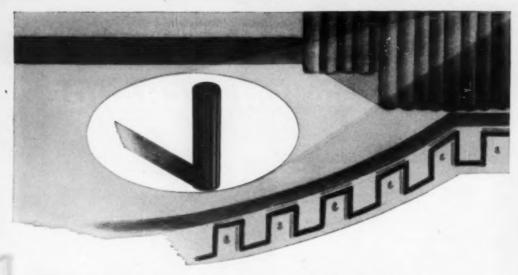
1946 Permutit was again first with the announcement of a highly basic anion exchanger, Permutit S, and introduced the revolutionary process for making silica-free demineralized water.

1950 For the latest in ion exchange research, look to the world's sole manufacturer of all types of ion exchangers and equipment.

Send for full information about these or any other ion exchangers and the equipment for their use to The Permutit Company, Dept. CE-1, 330 West 42nd Street, New York 18, N.Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal, Canada.







# Put the spotlight on fubing



Tubing is more important than you think. Unlike stage stars, however, tubing is a *silent* performer. And because you never see it work, you may lose sight of its importance and thus consider it a minor detail.

What happens when a line (tubing) lets go? You suffer a loss of production—and that is always costly.

Yes, tubing IS very important!

To make sure that your condensers and other units are equipped with tubing that is reliable, see that Wolverine tubing is installed.

Wolverine tube, you know, is quality-controlled from ore to finished product. You can depend upon it. All our efforts are concentrated on making tube as good as it can possibly be produced.

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# has the Lifting Power

I-R Air Hoists have the Reputation for lifting loads and profits

— raising output

— lowering fatigue

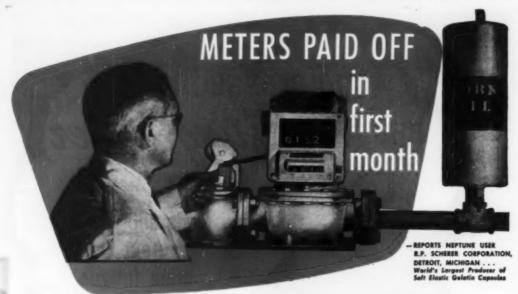
Too much human energy is wasted in the nation's industries doing laborious and back-breaking lifting and moving jobs. Agreed? Then let I-R Air Motor Hoists, large and small, eliminate this costly handling! When you use them, output goes up, costs come down.

Sturdy, compact, foolproof I-R Air Hoists are safe hoists; because the operator has complete control at all times, whether the hoist is running at full speed or at the slowest crawl. Automatic up and down stops prevent damage through misuse to both the hoist and the load. I-R Air Hoists are fine for rugged service, and work just as well in hot gaseous atmospheres.

You can't go wrong when I-R Hoists are on the job. Sizes available from 200 to 20,000 pounds capacities. Ask one of our Air Tool Specialists to show you how Air Hoists and Air Tools now pay for themselves nearly twice as fast and enable the workman to do more work with less effort.

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Ingersoll-Rand



By eliminating possibility of variation and errors in weight of materials, this precise Neptune Meter actually paid for itself in the first month! It measures corn eil into closely controlled batches containing expensive ingredients. It's the new Neptune Model which automatically cuts off the flow at the right quantity.

At right are shown a few of the other Neptune Meters for batching, blending, measuring deliveries, and simplifying cost accounting at R. P. Scherer Corporation. Somewhere in your plant, too, there's a spot where Neptune Meters—small or large—can save time and money. Sizes up to 650 gpm., for handling more than 100 liquids. Famous for simplicity, sustained accuracy, and low maintenance.

Our engineers will be glad to make recommendations. No obligation—just phone or write the nearest Neptune office for quick facts.



These two Neptune Meters handle glycerine and cold water in blending operation

Neptune Auto - Stop Meters accurately measure nophtha and ace-





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#### and all provide absolute control over tonnage handled in feeding and conveying operations



Small Reagent Feeders—with open or enclosed decks for capacities from 10 to 4000 the par hour. Spreading feeders—for distributing materials evenly acress wide surfaces.



Spark-Proof Feeders (left)—for use in explosive atmospheros or where moisture conditions require special protection of coils. Built in a wide range of types and sizes, Jeffrey electric vibrating Feeders and Conveyors provide absolute control over tonnage handled. Open or enclosed pan, or tubular decks, for capacities ranging from a few pounds to lifteen hundred tons per hour. Investigate the accuracy of this equipment.



Dust-Tight Feeders (right) — vibrating moter gaps protected from magnetic dust, or explosive dust,



Water-Jacketed Feeders (left)—for feeding furnaces and driers, or handling hot material to coolers, etc.



Coolers-Dryers—for processing operations. Direct type shown, for drying or cooling granular material. Equipped with either perforated or louvered conveying surface through which air or gasses are

Bin Level Indicator (above)
—shows bin level at a glance
to control feed to bin, maintain bin level or control discharging equipment.



Low Hend type Barrel Pecker (abeve)- a real economy in reducing size of centainers, increasing capacity and cutring shipping costs. Can be suppilled with deck to previde conveying action during packing operations.

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Because they have greater oxidation stability, the new STANOILs stand up under high temperatures of operation, maintain low acidity for longer periods of service which helps keep oil systems free from deposits caused by oil oxidation.

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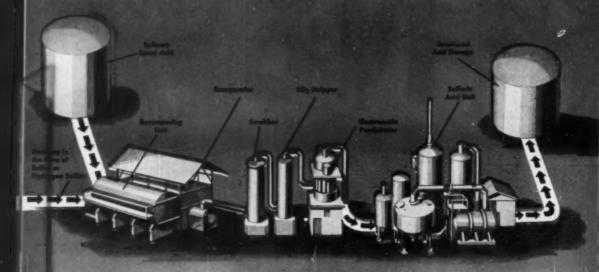
At the left are shown several types of equipment in which the new STANOILs can save you money and maintenance time. A Standard Oil lubrication specialist will help you find still other applications where versatile STANOILS can replace many special-purpose oils. You can reach this man quickly and easily through your local Standard Oil Company (Indiana) office. Contact him today. Or, if you wish, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)



CHEMICO OFFERS AN ECONOMICAL PROCESS FOR

# Spent Alkylation Acid Regeneration



Due to the increased cost of brimstone and the vital need to conserve basic sulfur deposits, petroleum refiners producing high octane aviation gasoline will find it desirable to recover the sulfuric acid from their spent alkylation acid. For this purpose, Chemico offers a proven and economical process.

In this process, spent alkylation acid—now in greater supply as a result of the increased manufacture of high octane gasoline—is aprayed into a furnace maintained at a high heat with auxiliary burners. Sulfur or hydrogen sulfide may be used as fuel thereby producing SO<sub>3</sub> gas for the production of make-up acid.

A limited amount of other liquid acid sludges, high in hydrocarbon content, may also be added to the alkylation spent acid, thus providing fuel as well as additional acid production. The hydrocarbons are completely consumed and the acid is broken down into its components—sulfur dioxide, oxygen and water. After the water is removed, the gas is processed to fresh acid of 98% strength in a Chemico contact sulfuric acid unit. Send for additional information, stating your requirements.

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The operator of this mixing process was just plain smart when he told his boss that he couldn't juggle the five different temperatures which must be exact at all times for successful production.

Sarco did the trick. Each of the ingredient kettles now has a Sarco TR22 regulator on the steam supply. Two tanks have a Sarco LSI electric indicating control, one of which is shown on the main control panel above, and the final mixing tank is held at exactly 212° with another Sarco.

The result is increased output because no time is lost, and repeat performance is insured. Of course, the combined operation uses less steam because none is wasted.

WHEREVER TEMPERATURES COUNT—The process engineer can be the boss. He can specify the temperatures he wants—and know that is how the job will operate. Furthermore, if he wishes to change the process it would take only a minute to reset the regulators.

A few of the Sarco controls used for batch operations are shown at the left. If you have a temperature control problem, try Sarco first.

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PROVES PRODUCT QUALITY AND QUIPUT

# has a special "aptitude" for its job

The design of Farrel speed reducers permits an engineering freedom in proportioning gears, shafts, bearings and even some housing dimensions to meet specific load, speed and service requirements. This flexibility has resulted in the solution of innumerable application problems.

In addition to this feature, Farrel speed reducers have a number of other advantages which help to account for their "aptitude" in handling tough assignments. The quiet, vibration-free performance of the herringbone gears results from extreme accuracy of tooth spacing, contour and helix angle . . . qualities inherent in the Farrel-Sykes method of gear generation. Precision manufacture and highest grade materials contribute to long gear life.

Shafts and bearings are factored to safeguard against interruption of vital processes. Gear cases are proportioned to withstand repeated heavy peak loads. Joints are sealed to prevent entrance of dirt.

Write for further details of these problem-solving units. Ask for a copy of Bulletin 449.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

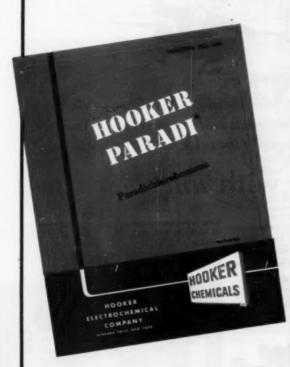
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FB-544

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A request on your company letterhead will bring this bulletin to you promptly. Chemists who are interested in other physical and chemical properties should ask for Technical Data Sheet 749.

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HOOKER's new Bulletin No. 454 on Paradichlorobenzene can be your guide to increased sales and profits if you are interested in the fumigant, deodorant and disinfectant markets. It describes the many uses and application of paradichlorobenzene, methods for reforming and repackaging—contains a table and illustrations of exact screen sizes—just the information a repackager or specialty manufacturer needs.

Hooker Paradichlorobenzene is a crystal clear, high purity product that evaporates completely, leaving no residue and no stains. It is not injurious to fabrics, furs or hides and is not poisonous to human beings.

It is made available in seven graduated sizes from powdered to Pea No. 1 (Screen size through 5%" on 2½).

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Appearance	. White	to clear transparent
Form		Crystals in 7 sizes
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Boiling Point		173°C
Residue on Sublimation		
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9-1587

SODIUM SULFIDE . SODIUM SULFHYDRATE . SODIUM BENZOATE . CAUSTIC SODA . MURIATIC ACID . PARADICHIOROBENZENE . CHLORINE

# Having valve trouble?



If leaking valves are fouling your chemical lines the most likely reason is seat failure. That's where acids and caustics make destructive attacks. But corrosion and erosion of the valve seats can be resisted.

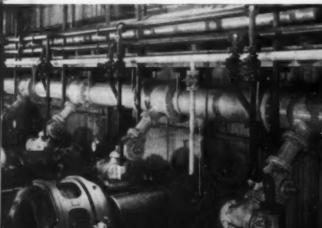
#### Install the valve with unexposed seat

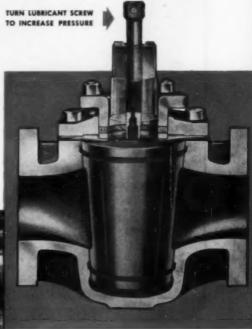
The seat of a Nordstrom valve is never exposed to the line. It is permanently lubricated. The plug cannot separate from its seat. Pressurized lubricant forms a seal around each port. The valve is automatically lubricated by using Hypermatic, the miracle lubricant.

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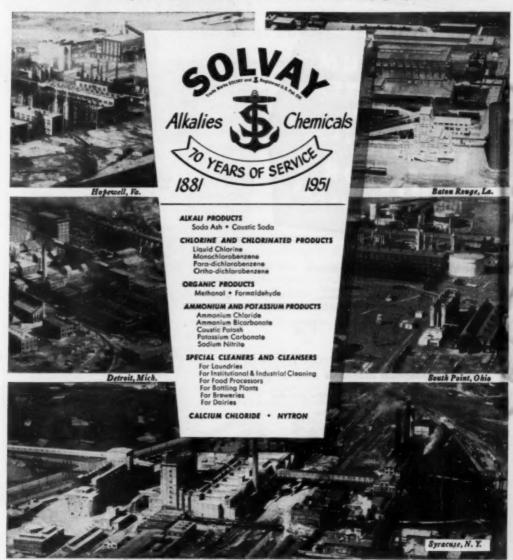
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#### 70 Years of PROGRESS

Progress can be measured in many ways...
Our progress, for example, might be measured by
comparing our original soda ash plant to our five
great plants that today have the world's greatest output of alkalies and associated chemicals. Or we might compare our early technical and research fa-cilities with our present laboratories—the world's

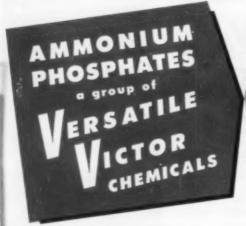
largest and best equipped for alkali research.
But the way we like to measure our progress is by
the steady year-by-year growth in the number of
firms and individuals who continue to "specify
Solvay." It is their feeling toward Solvay and Solvay
Products that has made this progress possible.



SOLVAY SALES BIVISION, Allied Chemical & Dye Corporation, 40 Rector Street, York 6. H. Y

Victor ammonium phosphates are used extensively by industry. Why not investigate the important properties of these chemicals which offer a wide variety of applications? You may effect a saving in your process or provide new advantages for your product.

Look over some of the regular uses listed below, and see which application or properties are interesting to you. We shall be glad to send you more information and samples at your request.



#### VICTOR MONOAMMONIUM PHOSPHATE

NH,H,PO.

A brilliant white crystalline or powdered material.
All grades meet U. S. Pure Food Law requirements.
Grades: Crystalline, powdered, and powdered F. F. (free-flowing)
Typical Analysis:

NH<sub>3</sub> (min.) 14.5% P<sub>1</sub>O<sub>5</sub> 61.0% pH (1% solution) 4.5

#### VICTOR DIAMMONIUM PHOSPHATE

BNH, LHPO,

A brilliant white crystalline material, mildly alkaline in reaction. Meets all U. S. Pure Food Law requirements.

Grades: Crystalline, powdered F. F., and dentifrice.
Typical Analysis: NHs

NH<sub>3</sub> 25.3% P<sub>2</sub>O<sub>5</sub> 53.5% pH (1% solution) 8.0

#### USES OF VICTOR AMMONIUM PHOSPHATES



Flameproofing paper, wood, textiles, and

Chrome dyeing of wool.





Acid cleaners and rust proofing metals.

Ammoniates dentifrices.





Manufacture of yeast vinegar, yeast feeds broad improvers,

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Write for Qualations, Technical Data, or Experimental Samples.

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# AND YOU CAN INCREASE PRODUCTION WITH CONTINUOUS SEPARATION THE

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CENTRIFUGAL WAY!

#### THE NIGHT RUN OF THE FAST FREIGHT

Processing, too, pays best when the production line flows smoothly—without unnecessary interruptions. Separation or clarification by means of De Laval centrifugals is the most effective way to eliminate "slow" spots once made necessary by gravity settling or inferior filtering. De Laval machines do in seconds by means of centrifugal force work that once took hours.

De Laval has had over 70 years of experience in solving problems of separation and clarification. Many hundreds of different substances and fluids have been tested during that time, and it may well be that some problem quite similar to yours has already been examined in the De Laval laboratory or in actual field use. If you would like to (1) separate two liquids continuously or (2) clarify one or two liquids continuously or (3) continuously separate two liquids and continuously remove solids from one or both at the same time, it will pay you to investigate.

THE DE LAVAL SEPARATOR COMPANY
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the First Name in Centrifugals
the First Thought for CONTINUOUS
SEPARATION · CLARIFICATION · CONCENTRATION

FOR THE LONG PULL AHEAD...

## DRIVE RELIABILITY WILL



With American industry once more placing its major emphasis on increased production, plant equipment must be ready for severe tests. One of the sure ways of keeping output high is the use of production tools with high reliability records.

Reliability in equipment drives means more than just the initial ability to meet specified performance ratings. You want to rely on the drive for trouble-free service after months of continuous operation. You want accuracy and economy to remain high with no loss in production time for special maintenance.

If your plant uses turbine drives, select the mechanical drive turbine that's designed for dependability under all operating conditions—General Electric's Type DP. From the totally enclosed governor to the durable babbitt-faced bearings, DP construction will provide greater productivity through greater reliability.

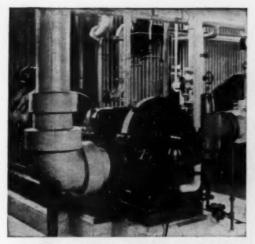
Totally Enclosed Oil Relayed Governing system has no mechanical linkages and few moving parts. It can't stick, gum or rust, even during long standby periods. You can always depend on the DP governor for accurate control over a 30% adjustable speed range.

Positive Lubrication adds years to the life of the turbine. Oil is fed under pressure to grooves in automotive-type, babbitt-faced bearings that also absorb shaft thrust and maintain accurate wheel clearance. A strainer assures that only clean oil is pumped to the bearings and governing system.

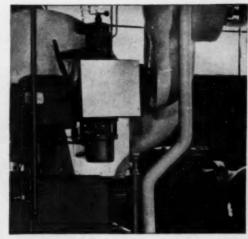
Rugged Construction and Quality Materials provide resistance to erosion and corrosion. Special steel nozzle plate, self-lubricating graphite packings, and Monel-sprayed shaft are examples of design features that keep parts replacement to a minimum.

Easier, Quicker Maintenance is part of the DP design: Standard parts are easily stocked for routine replacement. Disassembly is simplified by the use of socket-head cap screws throughout the turbine.

If you're not familiar with the DP turbine, why not write for a free copy of bulletin GEA-4955A. Or, if you prefer, call your nearest General Electric sales office. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

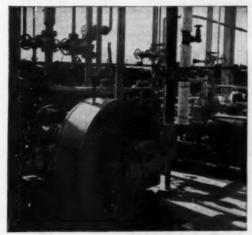


Here a 100 kw generator is driven through a gear coupling by a standard DP turbine. This kind of assignment requires accuracy and reliability such as you would expect only from much more expensive turbines.

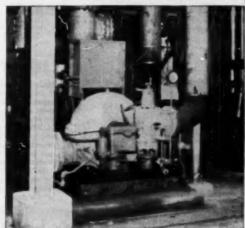


The DP turbine's totally enclosed governing system is always ready for immediate service—even after long periods of idleness. In this West Coast sawmill, DP's are used to drive standby fire pumps.

## BOOST YOUR PRODUCTION



You can install the DP anywhere—indoors or outdoors—without fear of parts corrosion. This standard DP is driving centrifugal pumps in an outdoor refinery installation.



In this refinery, DP turbines drive pumps used in the catalytic cracking process. Since installation, the turbines have provided dependable service—essential for important, continuous processes.

DP stands for Dependable Power

GENERAL 🤲





Adapted to product your Product

#### SPECIALLY ENGINEERED

In the constant search for new ways to Reduce Costs and Improve Production—keeping ahead of demand—we believe you can profit by the experience of many important manufacturers who are using INTERNATIONAL EQUIPMENT to (1). Minimize labor and handling open wight—(3) Meet exact mechanical and chemical requirements—(4) Improve the finished product.

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BLENDERS

The Standard of Lower Blending Costs for Hundreds of Chemical Products. For more rapid and efficient blending of any free flowing solid ranging from very fine mesh powder to large pebbles—particularly for the intimate mixing of pigments, colors and dyestuffs—Resin and plastic powders—Pharmaceuticals and medicinals—Food and grain products—Photographic

materials—Fine and heavy chemical powders—Fertilizers—Ore or metallurgical products. Made in many types and sizes, ranging in capacity from 25 to 10,000 lbs. for materials having densities of from 20 lbs. to 100 lbs. per cubic foot.



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#### International

Made in 4 different Drive Arrangements, and in 16 Standard Sizes, from ¼ to 175 cubic ft. capacity. Special Designs also available to meet specific floor space and other requirements. "INTERNATIONAL" RIBBON MIXERS are so fitted with a design relationship, outer to inner spirals, and the efficiency is such as to thoroughly mix a few ounces of one material with many pounds of another material. Heavy all welded construction. SIMPLIFIED AGITATOR REMOVAL—By simply removing bolts from companion flanges, the entire shaft containing the two spirals can be lifted out of the mill.

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SIDE ENTERING



#### Memo from the Editor sonn R. Callaham



WORDAGE



YARDAGE

#### New Editor at Work and at Play

We were sweating out our October deadline that afternoon when Hazel came in to say that one Richard Reeves wanted to see us about a job. After a few minutes Sid Kirkpatrick stuck his head into my office: "Wanna talk to this young fellow? Looks like he might have something for us."

It didn't take long to see that Dick Reeves certainly did have something for us. Yes, he'd had a proper chemical education at St. Peters. St. Peters? "... it's really a college—and a damned good one—a small Jesuit school in Jersey City. About six or seven hundred students. Got my chemistry degree in 1949."

seven hundred students. Got my chemistry degree in 1949."
Could he write? He thought so; anyway he'd just picked up a master's in journalism at Boston University's School of Public Relations. And for proof, Dick did the usual thing: handed over his thesis. ("Lord," I groaned to myself, "another evening to be spent with a thesis.")

I read that thesis on my way home on the Lackawanna ("Route of Phoebe Snow") dull, dreary commuters' train. And blithely went right on by my own station. My wife spent her evening with the thesis too—something she normally doesn't do.

Next day we hired Dick.
Our new assistant editor doesn't talk
much about himself. But before long
I began to learn more about him. How
he grew up in Chicago's Northwest
side with all the gangsters, lived just

a block from where Dillinger was shot. How his first job was selling papers at a take-home pay of 30 cents a week!

His only claim to fame, Dick swears, is that he once won a prize for knowing more than any other kid in the fifth grade about Tschaikowsky's Nutcracker Suite on one of Walter Damrosch's kiddie concerts. 'I had been digesting Beethoven since the age of one when I tried a couple of new teeth out on the Eroica and swallowed two phonograph needles for dessert. I became a longhair—and my mother's turned gray".

Dick's family came East when he was 14. He picked up a prep school scholarship because—as he puts it—he could tell a dangling participle from a split gerundive ("I can't now"). He went to St. Peters for several reasons; one was that he could roll out of bed at 8:45 and make his class by 9:15.

I don't believe it, but Dick claims his getting into chemistry was all an accident. It seems that he was cutting up in class one day when the teacher was explaining oxygen. About to reveal its discoverer, his eye caught Dick distracting the class. So, instead of saying, "Oxygen was discovered by the great Priestley", he blurted out "Reeves" instead. On the next quiz, a third of the class named Reeves as the discoverer of oxygen. The rest of the school picked it up; Dick was Oxygen Reeves, the chemist, from there on.

About that time Dick saw that chemistry and journalism was a rare combination, one that would be hard to beat. So he joined the school paper and ground the stuff out. It was then that he decided to take up journalism at Boston University.

To see the hefty game of golf Dick now plays (picture shows what form!) you'd never guess that in World War II he got himself perforated with bullets and shrapnel. Actually one bullet came within a quarter inch of his spine and of making him a wheelchair paraplegic for life. "I entered the Army as a kid—one week after high school—and almost didn't come out at all," he says and laughs. He never mentions his Bronze Star and Purple Heart.

Dick lives in Maplewood, N. J., with his wife Anne, aged 22, and daughter Sally Anne (Abie the Baby), aged 8 months. When there's time he likes to swim, listen to Beethoven,

take action pictures of people.

But actually, it was that rare combination of chemical and journalistic training that interested us most. We felt that maybe Chemical Engineering could stand a little livelier style here and there—just for variety. And if you've been reading our "New Products and Materials" department (p. 162 in this issue), you've probably noticed Dick's lighter touch. Most of all, though, it's showing up in the feature articles he edits for usof which there'll be more.

#### Bits and Pieces

• Remember that page of charts we run every month showing trends in production, prices and consumption? Most likely you do, for the readership study made recently by the Advertising Research Foundation showed that it's one of our top ten editorial items in readership score. We're featuring it this month (p. 121) in a new and dressed up form that I believe you'll like even better.

\* Coming: Two articles giving new data on how much labor, steam, electricity and water it takes to make a pound of some 60-odd different chemical products. Something different.

Looking for one of those "Little Boners" that usually appears on this page? Turn to p. 182 and you'll find it there. For readers who have been asking, "Did those things really happen?" the answer is "Certainly did."



#### This Steel-Service Team for Chemical Processing Requirements

Convenient to manufacturing centers from coast to coast, thirteen Ryerson steel-service plants stand ready to supply chemical process industries.

True, shortages resulting from the twin pressures of defense requirements and unprecedented civilian demand may make it impossible for us to furnish every item on every order, much as we would like to. But it is likely that many of your requirements are among the carbon, alloy and stainless steels we have on hand for prompt shipment. And experienced Ryerson steel men are always glad to work with you-help you make the most of available steel.

From switchboard to shipping floor all of us are ready to give you prompt service whenever humanly possible. So call us when you need steel

#### PRINCIPAL PRODUCTS

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PLATES—Many types including Inland 4-Way Sefety Plate

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#### RYERSON STEEL

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# Chemical Engineering WITH CHEMICAL & METALLURGICAL GENGINEERING

JANUARY 1951

#### We Battle for Production

No matter what turn the military situation may take, the ultimate outcome of our war against Communism will be determined by the strength and resources of American industry. To marshall its full forces in a period of national emergency we must squarely face at least three major issues—manpower, materials and productivity. Because each holds a competitive challenge for every industry and profession, the battle of production must soon become a battle for production. Chemical engineers and executives will have increasingly heavy responsibilities as this battle gets under way.

Metropolitan newspapers now carry large advertisements seeking men for defense plants. Aircraft plants on the West Coast report needs for literally hundreds of engineers, chemists and metallurgists. The expanded program for atomic armament may soon duplicate the technical manpower requirements of another Hanford or Oak Ridge. Nor is the current shortage confined to professional personnel. The labor supply of the entire country is becoming progressively tighter and we are warned by our economists that by mid-year it will reach a crisis, as serious as at any time during the last war.

Longer term prospects are even gloomier. A recent survey of the American Society for Engineering Education shows that, unless entering classes increase, the total number of engineers graduated in this country will fall from the June 1950 peak of about 50,000 to less than 10,000 in 1954. Yet the absolute minimum needs of industry are for 20,000 new engineers annually. Add to that the demands of defense plants and the military establishments. Result: an approaching crisis in engineering education as well as in industry.

Current shortages of certain chemicals and other critical materials are only beginning to be felt. Much of the pressure so far has come from the procurement program of the government in diverting scarce materials to its strategic stockpiles. As of July 1 the total accumulation was valued at \$1.6 billion out of a total

planned pile of 64 items costing over \$4.0 billion. Detailed data cannot be published for security reasons; but many chemical process industries are already feeling the pinch of this necessarily competitive program.

These figures are picayune compared with the total military program, estimated to exceed \$40 billion this year and \$50 billion next. Obviously any such output cannot come from diversion of civilian goods into military supplies and combat materials. The only answer is an all-out effort to raise American productive capacity—both by bigger plants and increased efficiency.

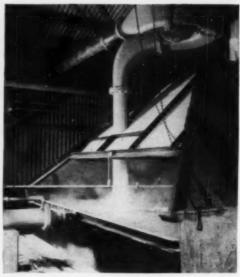
Fortunately the chemical process industries have long held the lead in capital expenditures for new plants and equipment. Plans for 1951 expansions reported recently in Business Week put chemicals first among manufacturing industries with a total of \$1,500 million—a gain of 23 percent over 1950. Petroleum is up 15 percent to \$775 million. Food, steel and textiles help bring the total to an over-all average of 20 percent above last year and 7.5 percent above the 1948 peak. Completion of these new and modernized plants will help materially to increase the national production of essential goods.

But even more output can be squeezed from present plants if we take full advantage of modern technological resources and management techniques. In every one of our industries there are opportunities for advances in processes and equipment that will raise efficiency and increase output. With an all-out war effort ahead, more and more plants will be running extra shifts and round-the-clock operations. Supplies of basic chemicals, metals and fuels will largely set the limits for these and other essential industries. It's time we get on with the battle for production.

Didney & Kinhpatrick



EVAPORATOR process yields cubic crystals. Salt slurry is withdrawn continuously from each evaporator through the salt leg.



GRAINER process gives flake crystals. Here the brine is entering the grainer pans. Average temperature in the pans is 215 deg. F

## HOW MORTON SALT Refines Salt Fights Corrosion Handles Solids

Morton Salt's refinery at Grand Saline, Tex., is the newest in the United States. Engineers are interested in its methods of solids handling and its corrosion-resistant materials of construction.

#### JAMES A. LEE

Three things at the new Grand Saline refinery of Morton Salt Co. impress most chemical engineers: (1) the two refining systems—vacuum evaporator and grainer—and how these determine the basic characteristics of the final products; (2) the different materials of construction that are used to fight corrosion of processing equipment and to prevent contamination of high-purity products;

SOUTHWEST EDITOR JIM LEE, who has followed advances in salt technology for two decades or more, writes from Houston: "This plant strikes me as a beautiful engineering job—a job both H. K. Ferguson Co. and Morton Salt Co. can really be proud of . . . and one that should interest chemical engineers throughout the process industries."

(3) solids handling methods and why they are so important that much of the equipment was specially designed or selected.

#### PROCESSES AND PRODUCTS

Raw materials at Grand Saline are rock salt and brine. The brine is refined by both vacuum evaporator and grainer systems; these are distinguished from each other by: (1) the method of evaporating the brine; (2) the way impurities are removed; (3) the type of processing equipment used; (4) the physical characteristics of the salt crystals.

The method of evaporation determines the type of salt grain. Open pan (grainer) evaporation gives a hopper-like crystal; vacuum pan evaporation gives a cubical crystal. Fragments of hopper crystals produce what

is known to the trade as "flake" grain. Many uses of salt require the high specific surface (surface area per unit weight) which the flake provides.

By using different methods of production, Morton is able to offer the trade many types of salts, each with distinct characteristics. By adding various compounding materials, the plant can turn out several hundred special-purpose salts.

Rock salt is used in cattle feed and in such manufacturing operations as synthetic rubber and ice cream. Flake salt—from the grainer process—becomes cheese salt or butter salt (a smaller flake with an extremely high rate of solubility) or anti-oxidant salt (with a chemical to retard rancidity in certain foodstuffs).

Granulated or cube salt—from the vacuum evaporators—becomes either

free-running or iodized table salt. In very fine size, it is known as "pop-corn salt." Special products include sulphurized block for stock feed; trace-mineral and calcium phosphate stock salt; calcium sulphate salt tablets for tomato canners; dextrose salt tablets for heat relief; pure tablets for general canning.

Rock salt is divided principally into two categories: coarse and fine. Under these are almost a dozen recognizable

orades

Since Morton's salt is largely used in foods and food processing, it must be very pure. Great care is taken in the plant to insure cleanliness and to prevent contamination from corrosion of equipment.

#### BAW MATERIALS

Rock salt—mined at a depth of 700 ft.—is given a preliminary crushing in the mine to simplify handling. It is crushed again at the surface. The crushed salt is carried by bucket elevator to the top floor of the mill building for screening. Vibrating screens of the Hummer type with two or three decks are used in multiple effect. Considerable re-screening and regrinding are necessary to give exact sizing.

Brine comes from the sand strata about 250 ft. below the surface of the ground and just above the salt in the dome. It is about 85 percent saturated. This brine is brought to the surface and then pumped into deep wells that reach into the salt dome at some distance from the mine.

Here it becomes completely saturated; it is then returned to the surface and sent to the plant through a pipeline. Salt in this dome is unusually pure—over 99 percent NaCl with traces of CaSO<sub>1</sub>. This high purity is characteristic of all salt domes along the Gulf Coast.

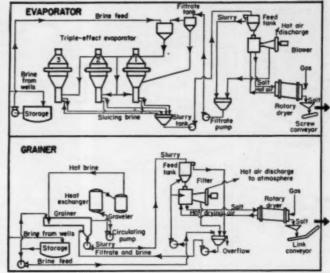
Brine is stored in large outdoor steel tanks. Here the bicarbonate alkalinity is reduced to remove traces of soluble ferrous iron that may have been picked up from pipelines and

pumps.

It is then passed through a specially designed filter in the line: this has a Monel screen and cotton fabric filter cloth. The brine is now ready for use in the evaporator or grainer processes. Calcium sulphate will be removed later, generally by brine laundering of the salt in a saturated brine suspension.

#### GRAINER PROCESS

Grainer salt is made by evaporating brine in long, shallow pans. The inside lining of these pans is protected by a neoprene rubber brine-resistant coating. The internal mechanism is



PROCESSES used by Morton Salt are triple-effect evaporator and grainer systems. Open-pan evaporation gives flake crystals; vacuum evaporation produces cubic crystals.

made of stainless steel, Monel or ordinary steel covered with a phenolic resin coating to prevent metallic contamination of the product.

Purified brine is fed into the grainer system and continuously circulated through the heat exchanger where the temperature is raised to 230 deg. F., a filter (where the calcium sulphate is removed) and the grainer pan. The pans are kept filled at all times. Average temperature of the brine in the grainer pans is 215 deg. F.

Salt crystals are slowly formed on the surface of the hot brine in the grainers. They then fall to the bottom where they grow in size. A Monel scraping conveyor system on the bottom of the grainers continually rakes the crystals towards the front end and discharges into a screw conveyor.

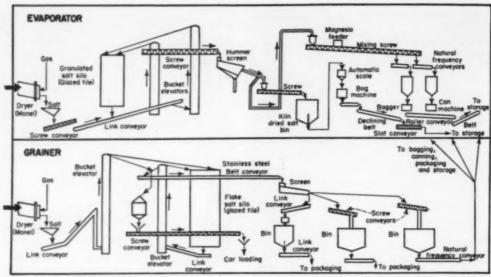
The slurry, composed of brine and salt crystals, is elevated to a supply tank directly above the salt filter by a slurry pump and 4-in. rubber hose. This dryer consists of a top-feed rotary vacuum filter which both dewaters and dries the salt to a low moisture content. The brine is returned to the grainer pan system. Salt flakes are conveyed to a rotary, cylindrical Monel dryer that is gas fired. On leaving the dryer the hot air passes through the vacuum filter already mentioned, where it also helps to dry the salt flakes. The air then passes off through the blowers and stack.

Hot, dry salt crystals pass through a scalping screen and are carried by a link (Redler) conveyor and bucket elevator to a glazed tile silo for storage. Or they may be conveyed direct from the elevator to a belt conveyor which delivers them to the mill building.

Link and belt conveyors are used because crystals made in grainer pans are formed in soft flakes; a screw conveyor would break the flakes into too large a proportion of dust and flour grades. A stainless steel belt is used since the flake crystals from the dryer in the grainer process are too hot to be handled by rubber; besides, the stainless steel prevents tarnishing and discoloration of the salt. Flake salt is a high-quality food product and must be protected from contamina-

All drying, screening and conveying equipment used in the process was specially designed or selected in an effort to prevent breakage of flakes. The crystals leaving the grainer pan are sent by a Moyno pump (with rubber stator and stainless steel rotor) to the filter.

Flake salt is screened in vibrating, stainless steel screens and divided into many specialized grades for the food industry. The various size products are conveyed from storage bins to packaging machines by natural frequency conveyors that screen and convey simultaneously. Screening is necessary immediately before packaging in order to remove any possible lumps of salt which may have gotten into the system. These grades are usually packaged in 100-lb. paper bags.



SOLIDS HANDLING is important to prevent damage to crystalline structure of products. Materials of construction must be selected with case to prevent corrosion of equipment and product contamination. Opposite page shows types of conveyors used.

Grainer salt crystallizes mostly on the brine surface where evaporation takes place. The crystals grow as additional cubes of salt become attached to the original nuclei. As the small cube nucleus grows, it immerses slightly; additional growth is therefore on the edge nearest the surface. The nucleus tends to take a rectangular form at the surface so that the crystal has flat sides formed by many cubes. These crystals are supported by the surface tension of the brine until their weight or some disturbance causes them to sink.

#### VACUUM PAN PROCESS

Vacuum pan salt is made by boiling brine at less than atmospheric pressure. The grains are cubical.

Purified brine is pumped from storage tanks to the vacuum pan system. Calcium sulphate is removed by counterflow hydraulic washing with brine. The lighter calcium sulphate washes out, leaving high-purity sodium chloride for further processing. Some brine is wasted in order to maintain a high-purity brine in the pans.

The triple-effect evaporator bodies are cast iron with steel sheets and copper tubes. Vapor lines are steel. Circulation is increased by using propellers. The shaft is stainless steel; the blades are Monel.

Formation of a salt scale on the tubes limits the operation. They must be cleaned off by periodic boiling with water. Operating cycle between cleanings varies from 48 hours to a week.

Salt slurry is drawn continuously from each evaporator through the salt leg. The brine is fed into the bottom of the leg so that the salt slurry is washed by incoming brine. Impurities are thus washed back into the pan where they are allowed to accumulate until the boiling-out period.

Salt slurry goes by gravity to a coneshaped tank; from there it is pumped to a feed tank above the rotary vacum filter for dewatering and drying. A 4-in. rubber hose, found by experience to stand up better against the abrasive and corrosive actions of the slurries, is used to transfer all salt slurries throughout the plant. The top-feed filter reduces the moisture content of the salt crystals by dewater-

The filtered and partially dried salt goes to a rotary, cylindrical dryer for final drying. This is a gas-fired Monel unit. Dry crystals pass through a scalping screen to remove lumps.

Dried granulated salt is conveyed by a screw to the bucket elevator which carries it to a silo for storage. It can also be carried directly to the mill building by a screw conveyor. Whenever production for the mill is below what is needed, the deficiency can be made up from salt already in the silos. A screw conveyor can be used for handling granulated salt since the cubes are not easily broken.

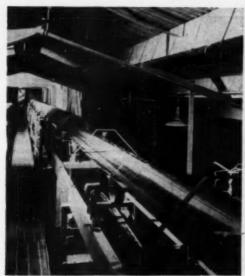
In the mill building vacuum pan salt is acreened, sized and packaged by equipment similar to that used for flake salt made by grainers. The conveying system from the screens in the mill building to storage bins is almost universally composed of high-frequency vibrating conveyors. This type of conveyor does not occupy much space. It utilizes the regenerative power of coil springs vibrating at their natural frequency to convey and scalp lumps simultaneously.

#### MATERIALS OF CONSTRUCTION

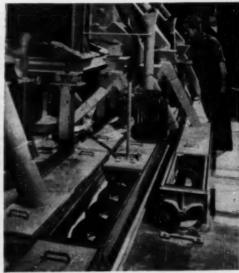
Morton engineers have done a lot of experimenting with various materials of construction. There is a twofold reason why the proper and best materials must be used throughout the plant.

First, purity and non-contamination are musts—as in all food industries. Every possible safeguard is taken to prevent even traces of impurities.

Secondly, corrosion of equipment could be a heavy economical loss. In this plant Monel and Type 316 stainless steel are used interchangeably for many purposes. However, Monel pipe lines and 4-in. rubber hose are more effective in handling hot brines and hot slurries. Stainless steel is largely used to prevent corrosion and contamination. Ni-Resist is used for hot brine pumps. Slurry pumps have rubber stators. Most bolts and nuts are stainless steel. All screw conveyors are covered with a protective coating of phenolic resin. Some neoprene coating is also used in the plant. Silos are constructed of glazed tile. Hardwoods are used for salt storage bins in the mill building.



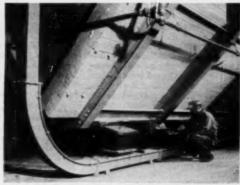
STAINLESS steel belt conveys salt crystals from dryers to packaging operations. The salt is still too hot for rubber to handle.



SCREW conveyors carry screened salt to bins. They can be used for granulated salt since the cubes are not easily broken.



VIBRATING conveyors (using the regenerative power of coil springs vibrating at natural frequency) carry vacuum pan salt.



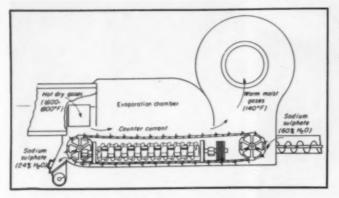
LINK (Redler) type of conveyor is best for handling flake salt made in grainer pans, which is soft and easily broken.

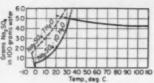


SLAT conveyor (wood) takes paper and cloth bags from declining abber belt (abown in background) that leads from storage.



DECLINING rubber belt handles some grades. Plant's six types of conveyors are of stainless, rubber, wood or phenolic-coated.





#### THE PROBLEM

Reverse water solubility curve of sodium sulphate creates dehydration problems. Glauber's salt melts at 91.4 deg. F. Above this point the anhydrous salt forms a heavy scale on all heating surfaces which it contacts.

#### **New Type Evaporator**

Designed to lick the sodium sulphate problem, this evaporator has eliminated the scaling problem, cut dust loss, slashed equipment costs and reduced fuel bills.

#### A. A. HOLLAND

Many patents have been issued for the dehydration of Glauber's salt; only a few have proved practical. Among those that have enjoyed some measure of success, were rotating steam drums that were partly submerged in the liquid where a scale formed. As the drum revolved the scale dried and was then removed by knives or scrapers. The large surface required per unit in addition to the difficulties encountered in removing the hard scale, made such equipment unsatisfactory.

Where a cheap source of common salt was available, satisfactory results have been obtained by its addition to a saturated solution of sodium sulphate. The presence of common salt inhibits the solubility of the sodium sulphate which is precipitated. A plant costing \$1 million was erected at Dana, Saskatchewan, to use this process. Lack of a common salt supply in the vicinity made it difficult to operate.

In Chile, a tower is used into the top of which sodium sulphate is

sprayed where it meets an ascending current of hot gases. Due to scaling on the inside of the tower, the results are questionable.

#### ROTARY DRYING PROBLEMS

About 1925 rotary single shell dryers came into use for the dehydration of Glauber's salt, and while they were a great improvement over equipment formerly used, they too experienced difficulty from caking, and are costly to operate. Since this method was in such general use, the difficulties encountered are given below:

 Heat loss through radiation. Due to the difficulties from caking, single shell dryers only could be used, with a result that a great deal of heat was lost by radiation. For example, a rotary dryer 80 ft. long by 7 ft. in dia., would lose 750 Btu. per sq. ft. per hr., or a total of 1,300,000 Btu.

2. The formation of rings inside the dryers was constant source of trouble, as they blocked the draft and at times broke, letting loose several tons of semi-dried sodium sulphate, which the operators usually referred to as "soup." Removing the scale from inside these dryers by picking out the hard anhydrous cake, caused a loss of from 12 to 16 percent of the operating time.

3. Dust loss. This is an expensive item often overlooked. In one factory, layers of dust 5 to 6 in. deep covered

the floor daily and required the labor of three men to collect. The losses up the stacks are estimated at two to three tons per diver per day.

three tons per dryer per day.

4. Fuel costs. The recovery per unit ran approximately 45 tons for an 80 ft. dryer, and the fuel used averaged 40 gal. per ton of anhydrous produced.

With a view to overcoming these difficulties, the Holland evaporator was designed, and after two years operation at the Saskatchewan government plant at Chaplin, the results obtained have proven to be highly satisfactory.

In development, it was realized that the only way to prevent scaling was by having the stream of hot gases and the sodium sulphate solution, meet in space where there would be no hot surface to which a scale could adhere. This was overcome by having the hot gases enter the machine through an inlet duct lined with refractory material. As they pass into the dehydration chamber, the solution is sprayed into this stream which is washed in much the same manner as air is treated in a rain storm.

The gases entering the machine at from 1,600 to 1,800 deg. F. are reduced to 140 deg. F. in a space of 8 ft., after which they are discharged by being drawn into an exhauster. The solution being treated, not only is raised in temperature, but a certain amount is evaporated with the result

A. A. HOLLAND is a consulting engineer. He has designed the Holland evaporator to overcome the problems involved in dehydrating Glauber's salt. Success of the evaporator in this operation can be seen in the Saskatchewan government's plant at Chaplin. It may find wider application soon.

that anhydrous is thrown down in the path of a scraper conveyor, and is discharged.

The spray is produced by two revolving "beaters," located on either side of the conveyor. They revolve at "beaters," located on either a speed of from 375 to 400 rpm. (depending on the solution being treated) and a series of cups located between the spirals, throws the solution through the stream of gases abovementioned. The spirals not only serve as a support for the cups, but serve to keep the solution or slurry, being treated in violent agitation. In practice it is found desirable to move the solution towards the feed end of the machine for as in the case of Clauber's salt, the hot liquid serves to cause the Glauber's salt to melt in their own water of crystallization.

The stream of hot gases is drawn through the evaporators by an exhaust fan with a capacity of 24,000 cu. ft. per min. This is equivalent to 1,333 lb. of air per min. at 140 deg. F. The humidity of the exhaust gases runs as high as 95 percent, but at 80 percent humidity with gases weighing 18 cu. ft. per lb., the rate of evaporation is about 4.6 tons per hr. This checks with the results that are obtained in actual practice. In connection with the operation of these machines on sodium sulphate, the Glauber's salt as fed into the evaporator average about 60 percent moisture, and are discharged with 24 percent moisture. This slurry then is run into a rotary dryer where the balance of the moisture is eliminated.

In the Chaplin plant there are four evaporators in use; two of these are direct fired as above described, and two utilize the exhaust heat from the two 60 ft. by 7 ft. rotary dryers used as final dryers. A total of 400 tons of anhydrous sodium sulphate are produced per 23 hr. Little if any of the slurry or partially dried cake adheres to the walls of the rotary dryers as the feed and temperatures are carefully regulated. However, should, for any reason, scale start to form, all that is necessary is to increase the feed. This will mean that some material not thoroughly dried, will be discharged

from the rotary dryer, but by recirculating this material through the dryer again it can be completely dried.

There is no dust loss, for any dust that might be drawn through the driers towards the exhaust end, must pass through the evaporators where it is scrubbed out of the gas current.

One important item is in connection with the cost of installation. A rotary dryer complete with transmission and motor, will cost from \$40,000 to \$75,000. The evaporators will cost one-third to one-fifth of this amount.

Heat radiation from the housing around these machines, is comparatively small due to the small area and the difference between the inside temperature and the ambient temperature. This in addition to the high efficiency of the machine as shown by the low temperatures of the exhaust gases has been responsible for the fuel savings effected. In the case above mentioned, whereas a total of 40 gal. of Bunker "C" oil was required when using rotary kilns, by use of the evaporators this was cut to 20 gal.

The system described in connection with the horizontal evaporators, is the same one used in connection with the rotary type. However, in the latter, the scraper conveyor is eliminated as the rotation of the machine automatically feeds the material being treated, to the revolving beaters. This machine is designed to take the original feed and reduce the moisture to zero, or it can be used as a final drier in connection with the horizontal type.

#### HOW IT WORKS

The advantage of using these machines in series is that any fine dust that might be carried past the dust collector is scrubbed out of the gases in the horizontal machine. Similarily, the gases are reduced in temperature.

In practice, the feed is delivered to the horizontal machine and the thick slurry discharged is fed into the rotary type by means of a screw conveyor. Where this conveyor passes the collector, it is covered on top, but between this point and the collector it is open and forms the bottom section of the exhaust gas duct from the rotary-type machine. The material being treated is thrown into the current of hot gases and if fine and dry enough, is carried to the collector which is actually an enlarged section of the gas duct fitted with a baffle to slow down the speed of the gas stream. The dried material falls into the bins below this point and is conducted to the bulk storage.

However, should the material leaving the rotary evaporation not be dry or light enough to be carried in the gas stream, it drops into the open section of the screw conveyor and here becomes mixed with the feed and is carried back into the evaporator.

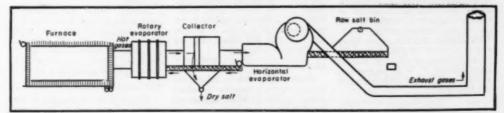
Another feature is the actual space required in a factory building. In a plant treating Glauber's salt, where rotary dryers alone are being used, in order to produce, 100 tons of anhydrous Na SO, per day, aside from the furnace or other equipment, the rotary dryers will occupy a space of from 80 to 110 ft. long and 30 ft. wide allowing a 10 ft. space between. The Holland evaporators to produce the same tonnage will require a length of 26 ft. and width of 10 ft.

In this article reference has been made repeatedly to the treatment of Glauber's salt and its dehydration. This has been selected since it is one of the most difficult materials to dehydrate. When a successful result can be obtained in treating it, most other materials will present few if any difficulties. For the treatment of other materials such as highly corrosive ones, changes have to be made to provide resistant materials of construction.

However, such materials as clays and lime sludge from water treatment plants present no problem. Mild steel can be used throughout the construc-

tion of the machines.

To summarize, these evaporators possess the following advantages: (1) The material being treated is dehydrated in space and scaling is avoided; (2) fuel costs are cut by as much as 50 percent; (3) dust losses are eliminated; (4) low first cost, lighter foundations and installation costs; (5) smaller space occupied per ton produced; (6) low labor costs; (7) Continuous operation.



This flowsheet shows the position of the Holland evaporator in the sodium sulphate process.

#### **Corrosion Resistance of Copper and Copper Alloys**

Published data on the corrosion resistance of copper and its alloys have been exceedingly sparse. Here in a three-part article are comprehensive data on these materials of construction.

#### Part I-Resistance to Common Corrosives

Copper and copper alloys have inherently good resistance to corrosion. They also have the property of forming films of insoluble corrosion products in many environments so that effective corrosion protection results. Copper and many copper alloys are sensitive to velocity effects. The prescence of oxygen or oxidizing agents in a solution generally accelerates the corrosion rates of copper and copper alloys. In the following paragraphs the effect of general classes of corrosive agents are described in relation to the corrosion resistance of some standard copper alloys.

ACIDS

Copper and copper alloys are rapidly corroded by oxidizing acids such as nitric and chromic. Corrosion by other acids is generally dependent on the presence of oxygen or some other oxidizing agent in the solution. Brasses containing at least 85 percent copper, and special brasses, can be used with many acids, but, in general, high-zine brasses should not be used with acids due to the danger of rapid corrosion by dezincification. Copper, red brass, phosphor bronze, coppersilicon alloys, aluminum bronze and cupro-nickel offer good resistance to corrosion by hot and cold dilute sulphuric acid and to corrision by cold concentrated sulphuric acid. Intermediate concentrations of sulphuric acid sometimes are more corrosive to copper alloys than either concentrated acid or dilute acid. Concentrated sulphuric acid may be corrosive at elevated temperatures due to breakdown of the acid with the formation of metallic sulphides and sulphur dioxide gas causing localized pitting attack. Tests indicate that the copper alloys may be corroded by pitting attack by 90 to 95 percent sulphuric acid at about 122 deg. F., by 80 percent acid at 160 deg. F. and by 60 percent acid at 212 deg. F.

Many copper alloys offer reasonable resistance to both dilute and concentrated hydrochloric acid at room temperature. Corrosion is more rapid when the acid is at elevated temperatures, especially when the acid is concentrated. Copper, red brass, phosphor bronze, cupro-nickel, aluminum bronze and copper-silicon alloys should be considered for handling hydrochloric acid.

Organic acids are generally less corrosive than the mineral acids. Equipment for the processing of acetic acid has for many years been made from copper, phosphor bronze, or coppersilicon allovs.

#### ALKALIS

Sodium and potassium hydroxide solutions of all concentrations can be handled at room temperature by copper and many of its alloys. Most of the copper alloys are resistant to hot dilute alkalis. Binary copper-zinc alloys containing more than approximately 15 percent zinc should not be used with alkalis due to the possibility of dezincification corrosion. Of the copper alloys, Super-Nickel is the most resistant to corrosion by alkalis.

#### AMMONIA

Copper and copper alloys are not corroded by perfectly dry ammonia but may be rapidly corroded by moist ammonia and ammonium hydroxide solutions due to the formation of soluble complex copper ammonium compounds. Moist ammonia, particularly in the presence of air, will cause intergranular corrosion of certain copper alloys. Of the copper alloys, Super-Nickel 702 is the most resistant to corrosion by moist ammonia or ammonium hydroxide and should offer reasonably good resistance.

#### SALT SOLUTIONS

Alkaline salts, such as sodium carbonate, sodium phosphate or sodium silicate act like the hydroxides but are less corrosive.

Neutral salt solutions are handled

extensively in equipment made from copper alloys. Brasses containing more than 15 percent zinc are not usually suitable due to the possibility of dezincification corrosion. Chlorides are more corrosive than sulphates. Mercury and solutions of its salts cannot be handled by copper or its alloys.

Acid salts, and many of the metal salts which hydrolyze, act like dilute acid solutions and may be particularly corrosive to copper alloys. Hydrolyzing compounds such as ferric chloride and ferric sulphate, which also have oxidizing properties, are definitely corrosive to copper and copper alloys. Salts having oxidizing properties, such as chromates, are not corrosive in neutral or alkaline solutions but are severely corrosive in acid solutions.

Sulphides are more corrosive to copper and alloys high in copper than to brasses such as yellow brass, Muntz metal, Admiralty or Tobin Bronze.

#### GASES

Copper and copper alloys are not attacked by dry gases at room temperature or lower.

Acetylene forms an explosive compound with copper when moist and alloys containing more than 65 percent copper should not be used with the wet gas under pressure.

Moist carbon dioxide is corrosive to brasses high in zinc but may be handled by other copper alloys. Tin coatings are highly resistant to moist carbon dioxide.

Moist chlorine gas is corrosive to all copper alloys.

Sulphur dioxide and sulphur trioxide in the presence of moisture form sulphurous and sulphuric acid, respectively. Copper, red brass, copper-silicon alloys, phosphor bronze and Super-Nickel should be considered for handling these gases when moist.

#### ORGANIC COMPOUNDS

Copper alloys are resistant to most organic solvents such as the acetates, alcohols, aldehydes, ketones, petro-

Material for this article is supplied by the American Brass Co., Waterbury, Conn.

leur. solvents and ether. Organic acids in aqueous solution may be handled by copper and most copper alloys but corrosion will be accelerated if air is present. Binary copper-zinc alloys with less than 85 percent copper may be rapidly attacked by dezincification.

Chloride hydrocarbons, such as carbon tetrachloride and trichlorethylene, are somewhat corrosive to copper alloys at the boiling point in the presence of moisture unless stabilized to keep them neutral or alkaline. Of the copper alloys, Super-Nickel and tincoated metal offer the best resistance to moist chloride hydrocarbons.

### FRESH WATER

Deoxidized copper and red brass are the most common pipe materials for conducting fresh water. Red brass is somewhat more resistant than copper to waters containing free carbon dioxide. Water containing free carbon dioxide may dissolve traces of copper from bare copper or red brass pipe. To avoid this condition, tin-coated copper or tin-coated red brass should be used or a suitable water neutralizer should be installed.

Deoxidized copper, deoxidized arsenical copper, and arsenical Admiralty ...e commonly used for condenser tubes handling fresh waters.

### SEA WATER

One of the important uses of copper alloys is for handling sea water. The most common alloys are arsenical Admiralty, Ambraloy 927 and Super-Nickel 702. Their good resistance to corrosion in this field is due to their ability to form films of corrosion products resistant to erosion by turbulently or rapidly flowing sea water. Arsenical Admiralty condenser tubes have good resistance to corrosion where water speeds are moderate. At higher velocities or where polluted harbor water is encountered, Ambraloy 927 is more resistant than Admiralty. Super-Nickel 702 has the highest resistance to corrosion by sea water of any of the condenser tube alloys and is widely used in the condensers of naval vessels. This alloy also offers good resistance to corrosion by polluted sea water. Cupro-nickel 754 is a recen de-

cupro-nickel 754 is a recent developed condenser tube alloy. It is superior to arsenical Admiralty and Ambraloy 927 in its resistance to sea water corrosion and is almost as resistant as Super-Nickel 702. Service tests also indicate cupro-nickel 754 to be comparable to Super-Nickel 702 in its resistance to polluted sea water.

### FOOD PRODUCTS

Copper and its alloys are resistant to corrosion by most foods and bev-

erages. However, consideration must be given to the possibility that such products handled in equipment made of copper or its alloys may dissolve traces of copper in amounts sufficient to discolor the product or alter its taste. In such cases it is recommended that the metal be tin-coated.

### PETROLEUM REFINERIES

Arsenical Admiralty condenser tubes are widely used in oil refinery heat exchangers and condensers whether fresh water or sea water is the coolant. In addition to resistance to corrosion from the water side, tubes in oil refinery service must be resistant to sulphides and chlorides which may be present in the condensing vapors. Aluminum brass (Ambraloy 927) tubes are being used in a number of refinery condensers where sea water is the coolant. Red brass condenser tubes have been used in several refineries handling sweet crudes, where fresh water was available for cooling. Red brass, however, does not resist sulphide corrosion as well as arsenical Admiralty. Red brass is also commonly used for acid-sludge lines in refineries. In condensers where vapor temperatures are above 400 deg. F., Super-Nickel tubes are often employed because at high temperatures this alloy is superior to these other alloys.

### STEAM

Copper and copper alloys are resistant to attack by pure steam. Steam containing carbon dioxide, oxygen and ammonia is not corrosive but the condensate formed will be corrosive, particularly to brasses high in zinc. Copper and arsenical Admiralty tubes are used in boiler feed-water heaters for low and moderate pressures and temperatures. Super-Nickel 702 tubes are preferred for high-presure and high-temperature heaters. Where the use of copper and its alloys for steam under pressure is involved, The A. S. M. E. Code for unfired pressure vessels should be consulted for limiting temperatures and unit stresses.

### Part II-Corrosion Rating Chart

The accompanying chart gives relative corrosion resistance ratings for copper and the commonly used copper alloys. These ratings are based on consideration of laboratory test data, service experience and a general knowledge of corrosion-resistant properties; however, it must be fully recognized that the ratings are relative only, and definite unqualified recommendations of corrosion resistance cannot be made.

A-The metal should be suitable under most conditions of use.

B—The metal offers good corrosion resistance. It may be considered in place of a metal with an "A" rating when some property other than corrosion resistance governs its use.

C-The metal offers fair corrosion re-

D-The metal is not suitable.

# Ratings of Allers Listed in Brackets Are Identical With Chart Ratings: Anaconda Copper 972 Silicon Copper 943 Silver-Bearing Copper 119 Silver-Bearing Copper 112 Silver-Bearing Copper 112 Silver-Bearing Copper 113 Deoridized Arseulan Copper 108 Leaded Copper 948 Leaded Phospher Bronze 944 Tobin Bronze 948 Tobin Bron

	Copper	Low-Zime Brum	High-Zine Brass	Special Brass	Phosphor Bronze	Alum- inum Bronze	Copper- Silicon Alleys	Cupro- Nickel	Nicke Silver
For Significance of Ratings See P. 100	Tough Pitch lised 939	Though Pitch Bronae errial Bronae errial Bronae 42 dge Bronae 61 Metal 66 Bronae 62 Admiraht cal Admiraht chor Bronae (Jor Bro	Everdur 1010 Everdur 1015	Cupro-Nickel 754 Super-Nickel 702	Nickel Silver 719				
Acetie Acid Acetie Anhydride Acetine Anhydride Acetine Acetylene Alcohole Alcohole Alleminus Hydrovide Aluminus Hydrovide Ammonius Myhate Ammonius Myhate Ammonius Mirtate Ammonius Mirtate Ammonius Mirtate Ammonius Mirtate Amyl Acetate Anyl Acetate Ac	BHADABABABADADDDDCAACCAAAABAAABAACBAAACBA	BBADABABABADADDDDCAACCAAAABAAAACBAAACBA	DD DA ABBDAD AD AD ADADDDDD C CACCEBBAAAADBBABBBBABBADAD AB BBDAD BBBBBACCCCAAACAADDDADDCCDADBCBBCCBDDDDDCCCDADBCBCBDADAD AD ADADDDDD C CACCEBBAAAADBBABBBBABBBBAADAD AA AADBBBBBAABAADDDABBBBAAAACAAADDDADDDDDCCDADBCBBBCCABBBCBDDDDDCCDADBCBBBCCABBBCBDDDDDCCCDADBCBBCBCBDDDDDCCCDADBCBBBAAAABBBBBAABAABBBBBAABAADDAAAACDDDBBBBBAACCCCAAACAAA	C C A D A B A C A C A D D D D D D A A C C A A A A A	BBADABABABABADDDDCAAACCAAAABAAAACBAAAACBAAAACBAABABBBBABABABABBBBBB	BBADABABABADDDDCAACCAAAAABAAACBAAACBAABABABAB	BBADABABABADDDDCAACCAAAAABAAACBAAACBAAA	BBADAAAABAACCCAAAAABAACAAAAACBAAAABAABABBBBABAAAAABBABABABACCBAAAAAA	B B A D A B A B A D D D D D C A A C C A A A A A B A A A A C B A A A B B B B

	Copper	1	Low-i	Zine	В	ligh-Z Bran	ine		Speci Bras	al	Pho	uphor onse	in	UM- UM OBER	Co 84 Al	oper- icon lays	Cu	pro-	Nicke Silver
For Significance of Ratings See P. 100	Elect. Tough Pitch 160 Decaidised 939		Commercial Broine 14	Reel Brane 34	Cartridge Brass 42	Architectural Broase 280	Munts Metal 66	Tobia Bromen	Arrenical Admiralty 439	Ambraloy 927	Phosphor Bronne (A) 351	Phosphor Bronse (D) 354	Ambraloy 901	Ambraloy 917	Everdur 1010	Everdur 1015	Oupro-Nickel 754	Buper-Nickel 703	Nickel Kilver 719
Gelatine Glucose Gluco	AABACACDCBABADAAABACBBAAADAAACADABBBBAACBBAADBAAABADAABBBBBBAACBCBCBCB		AABACACDCBABADAAABACBBAADAAACADABBABACBBADBAAAABADABBBBBBBB	AABACACDCBABADAAAABACBBAAADAAACADABBABACBBADBAAABADABBBBBBBB	BBCADADDDDACACAAACABBDACCDAACDADACCACCADCCBABCCCDBCDDCCCADDDCCCBBBDDBCCCADAADADDDDBBCCADACBADCCDD	BECADADDDDACACAAACABBDAACDAACDADACCACADCBABCCDBCCD	BBC ADADDDD AC AC AAAAC ABBD AC DAACDAD AC C AC AD C C AD C BAB C C DBC DD C C AD DD C D C BBB DB C C AD AAD AD DD DD BB C AD AC BAD C DD	BBCAD ADDDD ACACA BBD ACD AACD AD ACCACAD CCAD C	AABACACDDBABAGAAAABABBCAADAAACADABBABACBBADBAAAAADABBBBAADBCBCBCBAAABBBBABADAABACCCBBAAAACABAACACB	AABACACDDBABADAAABABBBAAADAAACADABBAACBBADBAAAAAADABBBBBADBCBCBAACBBAABBDAABABCBBAAAAACABAACACBB	AABACACDCBABADAAABACBBAAACADABBAACBBADBAAABADAABBBBBAADBCBCBAAACBCBCABBDAAABABAABAABACB	AABACACDCBABADAAABACBBAAADABABABACBBAADBAAAAAADBBBBBAADBCBCBAAACBCBCABBDAAABABABAABAABACB	AABACACDCBABADAAAABACBBAAADAAACADABBBABACBBAADBAAAAAADABBBBBAADBCBCBBBACBCBBBAAAABABAABAABAABAAABA	AABACACDCBABACAAABACBBAADAAACADABBAACBBADBAAAAAADABBBBBADBCBCBCBAABBBDAABBABAABABAABACB	AABACACDCBABADAAAHACBBAADAAACADABBAEACBBADBAAABADBABBBBBBADBCBCBAACBCCBBDAAABABAABABACBCB	AABACACDCBABADAAABACBBAADAAACADABBABACBBADBAAABADABBBBBADBCBCBCBAACBCBBBBAAAABABABAABACB	AAAACACDCBABADAAABACBBAADAAACADABBABACABADAAAAAAAA	AAAACACDBBABACAAABACBBAADAAACADABBABACABADAAAAAAAA	AAAACACDCBABADAAABACBBAADAAACADABBABACABADAAAAAAAA

### Part III—Composition Table

Note: The tabulated values are average, and, because of manufacturing limitations, should not be used for specification purposes.

Name	Numinal Composition—Percent											
	Cop- per	Zine	Tin	Load	Alumi- num	SHI- 900	Man- ganoos	Othera				
0000000	-											
COPPERS Electrolytic Tough Pitch Copper—100 Decadaed Copper—230. Silver Bearing Copper—113												
Copper-100	98.94							P. 0.09				
Bilver Bearing Coppor-113	99.5							P. 0.02 10 to 15 c				
Silver Bearing Copper-113	90.9							Ag per too 25 to 30 o				
Dessidised Arsenical Cop-								Ag per ter				
per-108	99.88							An, 0.30;				
	99.40							As, 0.30; P. 0.02 Se, 0.00				
Seimum Copper—948 Leaded Copper—948	99.00			1.00								
BRASSES												
Gilding Metal—4. Commercial Bronze—14	95.00	5.00	*****				*****					
Red Brass —24 Low Brass —32	90.00 88.00 80.00	10.00 15.00 20.00										
Cartridge Brass-42	76.00	30.00				****	*****					
Yellow Brass-50 Vellow Brass-61	76.00 65.00 63.00	35.00 37.00					*****					
Cartridge Brass 42 Yellow Brass 59 Yellow Brass 61 Munta Metal 36	60.00	40.00										
LEADED BRASSES												
Leaded Commercial Bronce -201	99.60	10.00		0.40								
sended Commercial Bronse		-	****									
-202	58.50-	10.00		1.80				******				
	66.50	33.00		0.30								
Proc Cutting Tube Bran- 282	55.50	31 90		1.60								
perial Threading Brass-		-										
	65.00 64.25 64.00	34.75 35.25 35.00		0.25			*****					
lutt Brass-229	64.00	35.00		1.00								
tule Braze 238. Free Cutting Yellow Braze -371				3.00								
Jork Brass 243 Smiled Munta Metal 274 Proc Cutting Munta Metal 288	62.00 61.50 60.00	35.00 37.00 39.50	*****	1.80	*****			*******				
Lended Munia Metal 274 Prop Cutting Munia Matal	60.00	39.50		0.50		****						
-303	60.00	39.00	*****	1.00				*******				
Forging Bruss-280 Extraded Ambitectural	00.00	38.00	*****	2.00	111000		*****					
— 503 Forging Rosse—230 Estruded Amistertural Broose—230	56.00	41.50		2.80		****						
SPECIAL BRASSES												
High Strongth Commorcial Bronze-256	90.25	6.90		1.78				Ni, 1.00;				
	87.25	11.50	1.25					0.10				
Sieces Red Brane-1027	82.00	17.00 18.00	1.00	*****	*****	1.00		*******				
Principal Bran 435	81.00		1.00		*****			******				
Neede 400 Millione Red Braue 1027 Trumpet Hrane 438 In healey 227 (Aumonian Braue) Aramical Admiratty 420 Naval Braue 400 Naval Braue 400 Seede Naval Braue 500 Seede Naval Braue 500 Manganese Braue 507	76.00	21.98 25.96	1.00		2.00	****		As, 0.04				
Naval Brass-480	70.00 60.00	28.96 39.25 39.25	0.78 0.78 0.78 0.78		******	****		As, 0.04				
Tobin Bronse	60.00 60.00	38.55	0.78	0.70			*****	*******				
Lended Naval Braze-612.	80.00	37.25	0.78	0.70				*******				
Manganese Bennae-337	50.00	39.00	0.70			****	0.80	Iron, 0.8				
PHOSPHOR BRONZES												
Phosphorus present in all alloys of this group.) Phosphor Brouse—256 Sgnal Brouse—361.												
Fionphor Brouse—356 Sens Brouse—361	96,75 96,25		1.28	****								
	95.75		4.00				-					
Phon. Bronze, 16% (Grade	-			*****	******	****		P, 0.83				
A)—381 Leaded Phas. Brease, 5% (Grade B)—979. Phas. Brease, 8% (Grade C)—383.	95,00		8.00		*****	****	*****					
(Grade B)-979	94.00		8.00	1.00			*****					
Phos. Bronze, 8% (Grade C)—353.	92.00		8.00									
Phos. Bronse, 10% (Grade D)—384.	89.50		10.80									
Speci. Prec Cutting Phon. Br's of -010.	-			-	*****							
Br'm63-610	88.00 96.25 88.00	4.00	4.00	4.00	*****		0.26	Fe, 0.50 Fe, 1.00				
Phosphor Broose—314 Phosphor Broose—316	88.00		10.00				1.00	Fe, 1.00				
ALUMINUM BRONZES												
Ambraloy-901	98,00				5.00	****						
Ambraloy—928 Avialite—915	95.00 92.00 99.25		0.40		8.00 9.25			Ni, 0.80				
Ambraloy-917	12.00				9.80		1.00	Ni, 0.80 Fe, 0.60 Ni, 8.00 Fe, 2.80				
								Fe, 2.80				
CADMIUM BRONZES												
BRONZES Titemac BB-001	99.00							CA 1.00				
Hitemac BB-001 Hitemac C-008	96,00	****	0.86			***		.Cd, 0.8				
COPPER-SILICON ALLOYS				_								
ALLOYS	05 PM					3,16	1.10					
Francius-1012	96,80	*****	0.4		*****	3.16	1.10 1.00 0.36	******				
	196,26	Feeses	Inches		7.00	12.04	P.20	******				
Everdur—1018 Everdur—1014	91.00			Ber		9.00	No.					

W	Heminal Composition—Percent												
Name	Cop-	Zine	Tim	Lond	Niek-	Alumi- mum	936- 90 ft	Man-	Others				
CUPRO-NICKELS (Manganese present in all alloys of this group.)													
Cupro Nickel-784	89.25				10.00	*****		*****	Pe, 0.78				
Cupro-Nickel, 20%- 712 Super-Nickel-702	en no	*****			30.00				Fa, 0.40				
NICKEL SILVERS Nickel Bilver 10%- 752	68.00												
Nickel Silver 10%-719.	85.00	17.00			18.00		****		*******				
Nickal Silver 10%- 724. Ambrac-850	88.00	27.00 5.00			18.00			*****	*******				
LEADED NICKEL SILVERS Extraded Leaded Nickel Silver, 10%—													
T 1.01.0 Winked Silver							1	1	******				
12%-796	68.86	22.00	****	1.00	12,00	*****		*****					
EPECIAL ALLOYS (laisum Brongs—951 Chromium copper—													
Chromium copper—	99.05	****				*****	0.10	*****	O.Al				

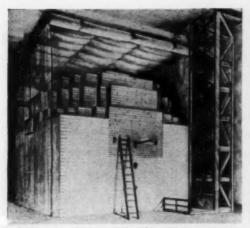
Some Typical	Industrial Uses
Of Copper Allo	ys
DREWERIES	
Piping	copper, red bress
Brow kettles	copper
Attemperator coils	eopper
DISTILLERIES	
Piping	copper, red brass
Mash kettles	eopper
Stilla	copper, arsenical Admiralty
Congression	cupper, aracinias Administry
GAS INDUSTRY	
Service lines	eopper arsenieal Admiralty
Cram cooler subsm	areonomic Admirancy
OIL REFENERIES	
Condenser and heat ex-	to a de trades. Garage Milabel 1980
changer tubes	arsenical Admiralty, Super-Nickel 702, Ambraloy 927, red brass
Tube sheets	Munts metal 274, naval brass, Super- Nickel 702, Ambraloy 917
Electrical conduit	Everdur 1015
Baffe plates	Munts metal, naval brass
Pipe and sludge lines	red brass
Pump liners	red brass
ORGANIC CHEMICALS	
Pipelines	copper, red brass
Condenser and heat ex-	to to to to the Manager Nitrobal
changer tobes	copper, arsenical Admiralty, Super-Nickel 702
Tube sheets	Munts metal 274, naval brass, Super- Nickel 702
Stills and evaporators	copper, Everdur 1010
PULP AND PAPER MILLS	
Water piping	copper, red brass
Stock lines	copper, Everdur 1010
Wire for Fourdrinier	
907960A	brass, phosphor bronss
Slotted screen plates	phosphor bronse, Ambraloy 928
Paper machine rolls of	and beam
Cylinder rods	phosphor bronse, Everdur 1010, com-
Cymoder rous	mercial bronse
Winding wire	Everdur 1015, signal broaze 361

SUGAR PROCESSING
Evaporator tubes...
Calandrias, sirup tanka,
missees.
Crystallising pans
Melting tanks.
Heat cachanger tubes.
Heat erchanger tube.

copper, red brase, assenical Admiralty Eveniur 1010

copper, amenical Admiraity, Super-Nickel 702, cupro sickel 754

copper copper arsenical Admiralty



ORIGINAL self sustaining nuclear chain reactor built at Chicago on a squash court and first operated on Dec. 2, 1942.



LAYERS 18 and 19 of the first atomic pile. Uranium is in 18. This is the only photo taken during pile construction.

# **Nuclear Reactors**

The government will now permit publication of certain information on the design, construction and operation of specified low-power reactors used for research.

On Dec. 2, 1942, man achieved the first self-sustaining nuclear chain reaction and thereby initiated the controlled release of atomic energy. The pile, a huge cube of graphite and uranium, had been constructed by a small group of physicists of the University of Chicago's Metallurgical Laboratory in a squash court of the university's Stagg field. It was operated at a maximum power level of 200 watts.

Instrumentation—As the construction of the West Stands reactor proceeded, a series of measurements was made to be sure that the critical dimensions were not reached inadvertently.

During the construction of the reactor, a Z x Z-in. slot running from the north face of the pile to slightly beyond its center was built into the eleventh layer. A boron trifluoride proportional counter in a graphite block was pushed along this slot to the center and instruments, located outside the reactor, made a continuous record of the counting rate.

Fission Process—The principle of operation of a nuclear reactor is simple enough. If in a mass of uranium one neutron causes a fission to occur resulting in the formation of two or more neutrons, it is conceivable that the number of fissions may increase steadily with the consequent release of sizable amounts of energy. How-

### FOUR REACTORS

... may now be described:

- The world's first nuclear reactor, constructed from uranium and graphite in 1942. Subsequently dismantled.
- 2. A modified version of the first reactor, located at the Argonne National Laboratory.
- A uranium and heavy water reactor located at the Argonne National Laboratory.
- A "homogeneous" enriched uranium, light water reactor located at the Los Alamos Scientific Laboratory.

ever, there is a great competition for these neutrons. The question of whether a chain reaction does or does not take place in a given structure depends upon the result. The four processes are:

- 1. Escape to the outside.
- 2. Non-fission capture by uranium.
- 3. Capture by impurities.

4. Fission capture by uranium. Moderator—The relative chance of fission capture depends upon the speed at which the neutron travels. The chance for fission increases if the neutron is traveling slowly. Fast neutrons are slowed down in passing through materials of low atomic weight. Hydro-

gen, whose atoms weigh approximately the same as the neutron, is a good moderator and low-weight deuterium, beryllium and carbon are effective moderators.

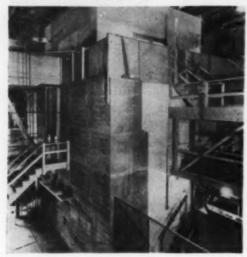
It was decided the West Stands reactor would be constructed with graphite. Experiments have shown that high speed neutrons resulting from the fission process are practically all reduced to low speeds, suitable for fission capture, after passing through 8 to 10 in. of graphite.

8 to 10 in. of graphite.

Impurities—Very careful purificacation of the uranium and the moderator is necessary to reduce the number
of cases of non-fission capture of neutrons by impurities. The maximum
amount of impurities are a few parts
per million in the uranium or the

moderating material.

Factor k—The whole success or failure of the construction of the first nuclear reactor depended upon the reproduction factor k. Suppose that there is a given number of neutrons present in a graphite-uranium system at a given time. Some of these neutrons, under proper conditions will cause fissions to occur and thus new neutrons will be released. The ratio of the number of newly created neutrons to the number of original neutrons is known as the reproduction factor k. If this number is greater than 1, the chain reaction is assured.



REBUILT uranium-graphite reactor has a 5-ft. concrete shield around the 20x22x21-ft. core. Note small laboratory on top.

### **Uranium-Graphite Reactor**

Operation of the West Stands reactor was terminated on Feb. 28, 1943, and the reactor was dismantled and moved to the laboratory's Palos Park site where it was reconstructed and provided with a radiation shield. Only 21 days were required for the dismantling, moving and reconstruction of the reactor, and on March 20, 1943, the Palos Park reactor, built of the same materials used at West Stands, began to function.

Description—The rebuilt reactor looks very much like a large windowless, two-story square concrete building. Its external measurements are: 30 ft. wide, 32 ft. long, and 21 ft. high. A small laboratory has been constructed on top of the reactor in which experimental work can be performed using radiation generated within the pile.

Inside the 5-ft. concrete walls is the reactor core, a cubeshaped pile of graphite into which lumps of uranium have been imbedded according to a predetermined lattice-type pattern. The top of the graphite-uranium pile is covered with 6 in. of lead and about 4 ft. of solid wood. The experimental laboratory is atop of this shield. Various controls and safety rods enter the sides of the

Various controls and safety rods enter the sides of the reactor from supporting platforms built around the faces or sides. Numerous openings are available in the front face of the reactor so that blocks of graphite (stringers) may be removed and test materials inserted into the active area of the reactor.

Construction—The concrete walls were first poured with the front and top open, leaving a vault in which the reactor proper could be built up layer by layer, in a space 22 ft. long and 20 ft. wide. As in the West Stands reactor, the basic construction unit was a graphite block 4½ x 4½ in. The length of the blocks varied but most were 16½ in. long.

Cylindrical recesses spaced 8½ in. from center to center were cut in the blocks. Uranium cylinders 2½ in. in diameter and weighing about 6 lb. were inserted into these recesses. Blocks prepared in this manner are called "live" graphite. Other graphite blocks containing no uranium, but were used simply as spacing blocks. These are called "dead" graphite.

The graphite blocks were cut to length and the uranium bodies were placed into the recesses to provide live graphite rows spaced by rows of dead graphite blocks across the pile to form horizontal layers. Each horizontal uranium-bearing layer was spaced from the layer below by a horizontal dead graphite layer, thus a three dimensional lattice was formed. All of the blocks were closely piled so as to reduce air spaces.

In order to reflect stray neutrons back into the reactor core, the uranium-bearing material was surrounded on all sides by at least 12 in. of dead graphite. The reactor became chain reacting or critical at the 50th layer. An additional four layers of dead graphite were then added above the 50th layer to complete the reflector across the top of the

Materials Used—Because of the relatively small amount of uranium metal available at the time of the construction of the reactor, a large number of the recesses were filled with uranium oxide. To use the available metal in the most efficient manner, it was placed in the center of the reactor and was surrounded with the uranium oxide lumps. Accordingly, live graphite pieces containing about 10 tons of metal lumps were piled in layers to form a central lattice mass about 13 ft. wide, 10 ft. deep and 10 ft. high, which was positioned between the 16th and 48th layers of the reactor.

The reactor contains about 3,200 uranium metal lumps weighing about 10 tons. About 14,500 uranium oxide lumps were used, bringing the total amount of uranium in the reactor to about 50 tons. The weight of graphite in the reactor is about 472 tons and the total weight of the reactor including core, reflector, shield and lead top is in excess of 1,400 tons.

Control System—As the reactor was being built, various slots or openings were provided for the control, shim, and safety rods. There are five control rods: a regulating rod and a shim rod on the north face of the reactor and three safety rods on the east face. These rods, 17 ft. long, are bronze strips covered with cadmium.

The safety rods are equipped with 100-lb, weights so that they are pulled into the reactor in the event of electrical power failure.

Neutron Column—Extending above the 54th layer of graphite was a dead graphite pier to act as a thermal neutron column for slowing down the neutrons and making them available for research. This column is several feet square and is about 5 ft. high and passes through the center of the lead and wood top covering the reactor core. Some neutrons created inside the reactor pass through this column of graphite and, as a result of numerous collisions with carbon atoms, their speed is greatly reduced. The column is covered with a cadmium layer in which a small opening has been provided. Slow neutrons passing through this opening in a narrow beam are used in numerous research activities. While the neutrons have been slowed down, they still travel at a terrific speed: 2,000 meters per second, or approximately 4,000 miles per hour.

### YOU MAY NOT MAKE A BOMB

"The information now releasable describes what must be known in order to assemble and operate a lownower research reactor. Before such a reactor can be built by a private institution, however, the permission of the government [AEC] to use the necessary fissionable materials is required."

### YOU CAN NOT MAKE A BOMB

"It is not practical to use low-power research reactors for producing atomic weapons or power."



OCTAGONAL shield incloses a 6-ft. aluminum tank filled with 6½ tons of heavy water and 160 (3 tons) uranium rods.

### **Heavy Water Reactor**

Because there was always the remote chance that graphite moderated nuclear reactors could not produce the fissionable material required for the program of the Manhattan Project, construction of a building was begun in September 1943 and on May 15, 1944 the heavy water reactor was operated at low power. Thus, it became the world's first heavy water nuclear pile.

Description-In comparison with graphite moderated reactors, the heavy water reactor is small. It consists of an aluminum tank, 72 in. in diameter and 105 in. high, which is filled with approximately 61 tons of heavy water and into which are suspended 120 uranium metal rods. 1.1 in. in diameter and 6 ft. long. The uranium rods, whose total weight is nearly three tons, are arranged to form a square lattice with the distance from center to center being 51 in. Heavy water is more effective than graphite in slowing down neutrons and does not absorb neutrons as readily as does graphite. To remove the heat created in the fission process, the heavy water is circulated through a heat exchanger.

The reactor tank rests on a 2-ft. layer of graphite blocks supported by the concrete pile foundation. The graphite reflects the neutrons to the reactor core. The sides are

provided with a reflector of equal thickness.

A 4-in. shield of lead-cadmium alloy surrounds the reflector and fits snugly against a thick concrete shield which encases the entire reactor. The lead-cadmium alloy protects the concrete from exposure to neutron and gamma radiation. A 1-ft. shield of lead bricks is placed on top of the graphite reflector and is continued over the top plate of the reactor tank. Between the bottom of the lead cover and the top plate of the reactor tank is a thin layer of cadmium metal.

Personnel during the loading and unloading of fuel are protected from neutrons by the cadmium and from gamma rays by the lead. The thick lead shield at the side and bottom contains copper tubing for circulating cooling water to remove the heat generated in the shield and in

the graphite.

The space between the heavy water and the cover of the tank is filled with helium. This inert gas replaces ordinary

air which would normally be present.

Blower pumps circulate the helium through a cooler and through a catalyst chamber. These pumps, circulate the helium gas and dissociated heavy water. Oxygen and heavy hydrogen are recombined in the catalytic chamber and returned to the reactor tank.

Biological Shield-The reactor core is surrounded with a biological shield which is in the form of an approximately octagonal concrete prism 13 ft. high and having walls 8 ft. thick. The top of the reactor is shielded with

a 4-ft. layer of wood and steel.

Openings—Eleven openings, closed by removable shielding plugs, penetrate the shield and the graphite reflector to provide facilities for measuring the neutron intensity of the reactor, for exposing materials to neutrons, and for permitting the passage of beams of radiation from the reactor. Four of these openings contain neutron detection instruments used in operating the reactor. The other seven may be opened to permit the passage of beams of neutrons or may be used to introduce materials into the reflector near the reactor tank for making them radioactive by exposure to neutrons.

Neutron Column-A thermal neutron column carries a beam of slow neutrons from the reactor. The column consists of a stack of ordinary graphite blocks 5 ft. square and 7 ft. 8 in. long extending back to the neutron reflector. The end extending through the concrete shield is covered with a cadmium contain and a 2-ft. lead and iron shield in which an 8-in. square opening is provided. When needed in research experiments, neutrons leave the reactor through this opening. The size of the opening may be altered by

changing the size of the cadmium cover.

Rabbit-In many experiments, materials made radioactive in the reactor must be removed from the reactor in a short time. A pneumatic tube arrangement called the rabbit was built into one of the eleven openings passing through the concrete shield. Materials to be irradiated are placed in small plastic cylinders and are shot in and out of

the reactor. Helium gas.

Central Thimble—In addition to the openings in the

sides of the reactor described above, an opening known as the central experimental thimble extends from the top of the reactor into the heavy water. This opening has been made by extending a 4-in. aluminum pipe from the center of the top shield, through the tank lid, and down to within a foot of the aluminum tubes through which various samples may be lowered into the center of the reactor for exposure to fast and slow neutrons. Thirty-two irradiations may be performed simultaneously.

Control System—The reactor is equipped with two control rods, two safety rods, and three shim rods. All contain cadmium metal so that they will absorb neutrons and

stop the chain reaction.

Cooling System-The heavy water is pumped from the top of the reactor, passed through a heat exchanger located in the adjacent pump room, and fed back into the reactor tank through an opening at the bottom of the tank. In this way 300 kw. of heat is removed from the reactor. The

heavy water flow rate is 200 gpm.

Operation-The controls for operating the reactor are located in a room near the reactor's north face. Here, an operator may measure and control all of the major aspects of the reactor's operation. To start the reactor, the operator merely pushes a button and the 32-lb. safety rods are pulled out of the reactor. By pressing another push button, one of the two motor-driven control rods is removed. To shut off the reactor, the operator causes the safety rods to fall back into vertical positions inside the tank.

WATER BOILER is an enriched uranyl solution in a container with control rods, cooling system and surrounded by shielding.

### Water Boiler

Plans for the water boiler, a homogeneous chain reactor using as fuel an enriched uranyl salt solution in water, were started in August 1943 at the Los Alamos Scientific Lab-

Preliminary calculations for the proposed reactor were carried through and the design for the first model (LOPO) was completed and developed. A second high-power model

(HYPO) was later designed and built.

Low-Power Reactor—The original water boiler design for a low-power reactor (LOPO) was completed in November 1943. It was decided to build this device before attempting the later model reactor of higher power. Its operation would indicate to what extent gales might be evolved from fission fragments and decomposition of the water and would reveal unforeseen difficulties in keeping the salt solution critical.

Assembly proceeded through the spring of 1944 and the system became critical in May 1944 with 1.2 lb. of U-235. The highest power to which LOPO was run during its several months existence was about 50 milliwatts, which raised the temperature to about 94 deg. F.

In view of the successful operation of LOPO, it seemed desirable to construct the high-power unit which would

provide a more intense neutron source.

High-Power Reactor—HYPO went critical in December 1944 with about 1.8 lb. of U-235, although the normal loading contains about 1.9 lb. of U-235. Except for minor design changes, HYPO, as originally constructed, has oper-

ated successfully for several years.

It has been used primarily for physical experiments requiring a concentrated neutron source. It is the smallest and most economical type of chain reactor so far built. The peak power of HYPO was about 6 kw., representing a neutron flux of about 300 billion neutrons per square centimeter per second at the center of the reactor. A slow or thermal neutron flux of the order of a billion neutrons per square centimeter per second is available for research purposes in the graphite tamper surrounding the reactor.

The heart of the reactor consists of a 1-ft. spherical stainless steel container filled with a uranyl nitrate solu-tion in water, known as "soup." The uranium in the uranyl salt contains about 1 part U-235 to 6 parts U-238.

Surrounding the container is a reflector, or tamper, consisting of an inner core of beryllium oxide supplemented by a shell of graphite. The reactor and tamper occupy a cube about 5 ft. on a side. A considerable amount of shielding is also necessary to protect operating personnel. The shield around the entire assembly consists of 4 in. of lead, & in. of cadmium, and 5 ft. of poured

At the front or working face of the reactor a square tunnel pierces the shield. This tunnel was plugged with graphite to form a graphite thermal column and a number of ports for experimental irradiations were placed in the column and the tamper. A 1-in. tube also extends through the shield, tamper and through the reactor sphere itself. Los Alamos workers call this the "glory hole." It permits materials to be irradiated at the highest neutron flux level.

A six-turn cooling coil of 1-in, tubing and having an effective length of 157 in. is wound in the form of a helix inside the sphere. About 50 gal. per hr. of water is pumped through the cooling system, which is sufficient to permit

year-round operation at 6 kw.

When operating, the water in the fuel solution is decomposed to about 1 cu. ft. of hydrogen and oxygen per hour. This mixture is extremely explosive and also since highly radioactive gases are produced, diluting and flushing out these gases was accomplished by means of a double inletoutlet tube welded to the top of the sphere. Air is pumped through the inner 1-in. tube and is exhausted through the outer 1-in, tube. The inner tube may be raised or lowered so that it acts as an indicator of the solution level. Also by leading the gas from the outlet tube through test equipment, rapid analysis of the boiler gas may be made. Copperconstantin thermocouples measure temperatures.

HYPO is controlled by cadmium rods: one shim, two

control, and a safety.

Under normal operating conditions the water boiler is self-regulating. As the temperature increases, the volume of the solution expands and the reactivity per unit volume declines. Under normal conditions it is impossible for the reactor to get out of control.

The neutron flux is measured continuously by means of an ionization chamber, coated with uranium 235.

Operation-All operations necessary to starting, running, and stopping HYPO are done from the control desk located in a room adjacent to that containing the reactor. Indicator lights and warning signals aid the operator in controlling the reactor and locating difficulties.

The reactor responds very rapidly to change in the control rod position, and this may be changed as rapidly as the operator desires. An experience operator can bring HYPO

up to full power in a few seconds.

With an inlet water temperature of about 45 deg. F. and 1.9 lb. of U-235 in the boiler, HYPO could run continuously at 5.5 kw. without exceeding a solution temperature of 185 deg. F., if this should ever become necessary. At this power level, some excess reactivity is available for experiments on materials which absorb neutrons.

After reaching a constant operating temperature corresponding to a power level of 1 kw. or more the reactor will maintain an operating level constant to within a few

tenths of one percent or better.

A small chemical laboratory was erected nearby to recycle fuel solution and to remove fission fragments. An underground stainless steel conduit carries soup from reactor to the chemical apparatus.

Since the successful operation of HYPO, the water boiler has been modified and improved in a number of ways to provide more efficient operation at higher powers. The details of these later improvements have not yet been declassified.

# Why Not a Suggestion Box for Engineers and Supervisors?

Part of their job? Perhaps. But too often it is the part that doesn't get done. How many times have you heard someone, even an engineer or supervisor, say, "It was a good idea, but . . .

- . . . I have so much regular work I never got around to it."
- . . . It's not really my business and I don't like to butt in."
- . . . They're set in their ways-why should I argue with them."
- . . . They got their backs up right away so I let it go."

### JACKSON B. LEONARD

"I'll tell you why we don't put up suggestion boxes for engineers and supervisors," many an executive will say. "We regard technical and supervisory personnel as part of the management team. Suggesting improvements is part of their job. Why should I pay extra?"

There is good reason for paying extra-it's profitable. One large and well known chemical plant saves around \$125,000 a year through suggestions turned in by its technical and supervisory staff of 70 people. An employer may say in principle that suggesting improvements is part of an engineer's job or a supervisor's job, but when you get down to cases he will admit that he is satisfied if they are efficient in their specific, assigned duties. He may hope for creative thinking, but he doesn't demand it. He can encourage it, though, by offering incentive and by removing obstacles. Without encouragement good ideas wither on the vine, even among technical men and supervisors. If that seems unlikely, consider this case.

An engineer was assigned the problem of studying raw material con-

sumption in a certain department. He noticed that materials handling in the department required the full time of three men and the part-time help of a fourth. It seemed to him that with certain mechanical assistance one man could easily perform all this handling. He worked out a rough plan and the idea looked good. It was practical and would definitely cut costs. But how was he to implement the idea? With no suggestion system to help carry the ball, the entire burden of proof was up to him. He would have to collect all the data to support his idea. He would have to give his own time or steal time from his regular duties. He would have to sell the idea to the affected department. If they showed resistance to change he would have to argue, push and very probably make himself unpopular. And for what? He had no assurance that his good offices in the company's behalf would be rewarded either in money or in terms of recognition. So he let it slide. He turned in a good report on his assigned study and the boss was happy. The company lost a money-saving idea.

This happens to be a made-up example, but there is nothing far fetched about it. The factors that contributed to the demise of this illustrative idea have killed off many real ones. These factors bear enumeration:

First, the engineer who got the idea was under no real compulsion to do something about it—despite anything his management might theorize about ideas being part of his job. Second, he could see no clear advantage to himself—he might get credit and he might not. But, third, he could see the obstacles clearly enough—extra work on top of his regular duties, plus the prospect of antagonizing people in the affected department. In short, he

faced no compulsion, no incentive.

How would a suggestion system have helped? In two important ways. It would have provided the incentive; there would have been definite assurance of reward for good ideas and extra work. Even more important, a suggestion plan would have removed the element of antagonism; a "George" would have been created to push the idea through any opposition the affected department might offer.

Now let us see how a good suggestion system is set up. There are three essentials if the system is to be effective in stimulating a flow of ideas.

1. Establish a committee to evaluate suggestions.

Ideas submitted by technical and supervisory personnel will be technical in nature, and a technically trained engineer will be required to head up the suggestion committee, either full or part time depending on the number of employees. Other members of the committee should be the suggester's supervisor, the plant manager and the supervisor of the department that the suggestion affects.

JACKSON D. LEONARD is a consultant, an ex-Du Ponter, and a four-time author in Chemical Engineering. Like this one, his three previous articles (Oct. 1949, Aug. and Sept. 1950) dealt in ideas for management—ideas that pay off. His address: 245 Rose St., Metuchen, N. J.

2. Inform the suggester upon receipt and final disposition of his sug-

gestion.

This simply recognizes human reactions. Anyone who has taken the time to work up an idea wants to know it is being considered and what comes of it. If the idea is rejected the suggester will want to know why; possibly he can modify it to make it acceptable. Likewise, if the idea is accepted, the suggester will be pleased to hear the news and interested in the amount of his award.

3. Establish a firm award system with definite rules that are known to

everyone.

This is a very important part of the plan. The award rules must provide incentive without being so attractive that normal duties are neglected trying to develop ideas. Actually, the most important incentive is the formal recognition of an idea and its originator, but a nominal monetary award gives an extra spark to stimulate extra effort. A typical set of award rules might be set up along these lines:

No individual award will be paid for suggestions which result in net savings of less than \$500 per year, but every accepted suggestion, regardless of amount, will be recorded under the suggester's name and at the end of the year a cumulative award will be paid amounting to 1 percent of the total net savings for that year.

A congratulatory or thank-you letter will be sent to each suggester for every accepted suggestion. This letter should be signed by the plant manager or other high company official.

A tactful explanatory letter listing fully the reasons for rejection will be sent to each suggester for each rejected idea. This letter should be signed by the engineer who heads the suggestion committee.

Awards will be based on net annual savings, which will be obtained by calculating gross annual savings and deducting federal income taxes, administrative expenses, and one-fourth the cost of any facility required to

gain the saving.

The maximum award that will be paid for any accepted suggestion will be 10 percent of the net annual saving, as determined above. This maximum will be subject to certain deductions as follows. (a) "Line of Duty." Deduct from 0 to 100 percent of the award if the suggestion is in the suggester's working area or department, or directly related to an assigned problem. The amount of this deduction is to be determined by the suggestion committee subject to final management approval. (b) "Origi-

nality." Deduct from 0 to 50 percent of the award if the suggestion duplicates a facility which exists elsewhere on the plant. The amount of this deduction is to be determined by the suggestion committee subject to final management approval. (c) "Responsibility." Deduct from 0 to 100 percent of the award depending on the suggester's position in the company. Personnel up to and including department heads are eligible for awards, but a sliding scale of deductions based on position will be used. This scale will be a matter of individual company choice.

To illustrate our complete plan more fully, let us examine a typical case from beginning to end. We can take the materials handling idea cited previously—the one that came to nothing when the originator was offered neither help nor incentive to push it along. Now that a suggestion system is in effect, we will assume that he writes up his idea, telling first how the materials are being handled, then describing in a detail his proposed new method. He also makes a rough calculation showing that his method would reduce labor costs by about \$8,000 a year, and in addition would make the work easier to perform, thus reducing the risks of the present heavy, manual operation. When the idea is written up he sends it to the suggestion engineer.

Upon receipt of the suggestion, the suggestion engineer stamps a number on it and records the number and title, first in a record book that lists all suggestions consecutively, and then in a separate record book under the suggester's name. He then uses a memo form to notify the suggester that his idea has been received, and the number that has been assigned to it. As soon as time permits, he goes into the department and observes the condition described in the suggestion. He talks to the department foreman and the suggester and then recommends that the proposed system be adopted, giving the estimated cost of the proposed new facilities.

The suggestion engineer passes the suggestion along with his recommendations to the supervisor of the department affected. When the department supervisor has reviewed the suggestion and recommendations, and recognized that the suggestion is sound and would bring definite improvement to his department, he approves the idea but notes several minor modifications. Then he passes it on to the suggester's supervisor, who is a Technical Department group leader. The supervisor notes on the recommendation sheet that the suggestion

was not an assigned problem and that it was the first application of that particular method of materials handling in the plant.

The suggestion then goes to the plant manager, who reviews the findings of the committee. He agrees with their evaluation, approves the suggestion, and returns it to the suggestion

engineer.

The suggestion engineer drafts a letter of congratulation to the suggester and also drafts the necessary project to effect the installation of the new facilities. These he returns to the plant manager for signature and

subsequent action.

After the new facilities are installed and in satisfactory operation, the suggestion engineer reviews the project, recalculates the annual savings and obtains the final cost of the installation. From these figures he finds that the gross annual labor saving amounts to about \$9,000. From this amount he deducts 43 percent for federal taxes, which leaves \$5,130. From this, he deducts administration expenses which are set at 10 percent, leaving \$4,620. Since the new facilities cost \$8,000 he deducts a quarter of this amount, which leaves \$2,620 as the net annual savings. Since our award rules specify that 10 percent of this amount is the maximum that can be paid, the suggester is eligible for an award of \$262 if no deductions are in order. Review of the recommendations reveals that the suggestion was not an assigned problem or directly related to one, so that no "line of duty" deduction should be made. Likewise, since the installation was the first of its kind on the plant, it rates as a completely original idea, and no deduction should be made for originality. Lastly, since the suggester is not rated on the responsibility scale. the full award value of \$262 is recommended and paid.

Let us look very briefly at the results accomplished:

The company gained labor savings of \$9,000 a year.

2. The suggester received a cash

award of \$262.

The company discovered that the suggester was capable of good creative thinking and would bear watching as possible executive timber for the future.

 The suggester had the satisfaction of receiving formal recognition and reward for his work.

With this impressive array of results, it is little wonder that one large and prosperous company has termed its supervisory and technical suggestion plan its "first line of progress and profit."

# Editorial Viewpoints

### "Children of Depression"

Back in the early thirties, we celebrated the birth of new products and processes from the research laboratories of chemical industry. Some of these "children of depression" were to succumb to the hazards and diseases of childhood while others have grown to energetic and elastic youth. Is it possible we concentrated too much attention on these laboratory "children" and not enough on a new generation of engineers to carry on with our work?

Judging from recent college enrollments we are soon to suffer the result of our indiscretion. According to a study made by the American Society for Engineering Education, the total of the freshman classes in all universities and colleges has been dropping at an alarming rate. From an all-time high of 57,507 in 1947, it fell to 47,672 in 1948, to 36,508 in 1949 and to an estimated low of 26,500 in 1950. And based on present high-school enrollments, there will be a further but gradual decrease in high-school graduates totalling 10 percent by 1953.

These pranks of nature portend a serious crisis not only in education but in the industries most dependent upon engineering manpower. Not only are there fewer high-school students approaching college age but there has been a serious decrease in the percentages enrolling for engineering courses—from 5.3 in 1947 to 2.2 in 1950. The sad result is that industry's supply of engineering graduates is due for some drastic declines.

Assuming that Selective Service did not draft any more students from engineering schools, the graduating classes in the next four years as estimated by Dean S. C. Hollister of Cornell will be as follows: 1951, 32,500; 1952, 21,900; 1953, 17,000 and 1954, 12,400. Yet he holds that the minimum crop of new engineering graduates needed by industry and government each year is in the neighborhood of 30,000. So in these critical times, the nation faces an annual deficit of from 30 to 60 percent of its engineering requirements.

There are two things every one of us as engineers can do that will help in the present situation. One is to impress on local draft boards the necessity for conserving our dwindling supply of engineers by permitting student engineers to complete their schooling before going into military or essential industrial services. The other equally important objective is to stimulate greater interest among high-school students in the study of engineering. It is a challenging and uncrowded field despite the misleading reports to the contrary once circulated but since withdrawn by the U. S. Bureau of Labor Statistics.

### Where Leadership Is Lacking

For months it has been evident that the people generally have been well ahead of the President and Congress in their desires for action in meeting the national emergency. What has been and is still lacking is strong and purposeful leadership. People with sons and neighbors' sons in and out of Korea do not need to be reminded of the seriousness of the situation. They want full speed ahead in meeting all military needs, even if it means a drastic reorganization of their daily lives.

Too many in Washington proceed on the assumption that the American people live in a vacuum of ignorance. This is particularly unfortunate when those in government assume and imply that industry is unwilling to do its full share in meeting the nation's needs. In the case of rubber, to cite one example, both the producing and consuming industrics sought official action to supply more synthetic rubber long before Washington was willing to recognize the impending emergency. Several other chemical enterprises have been manufacturing war materials far faster than the military has been willing to contract for them.

### Facts vs Rumors

Washington's rumor factory is working overtime. Latest is that we'll soon have too much synthetic rubber because the automobile industry will be curtailed by tighter credit restrictions and lack of metals. The truth, of course, is that the military needs for tires and other rubber goods for the defense program will take all the GR-S we can make. And, of course, there is such a thing as a stockpiling program, which is already beginning to pinch certain of our industries.

Next will probably come stories of gasoline rationing or no nylons for the ladies. Before long the black markets will again be thriving.

What can and should the industries do to correct emotional and fallacious reasoning? The only answer we know is to keep hammering away with the facts especially in high places.

### Worth Remembering

In two straight years during World War II,
American industry turned out almost as much armament as all of our enemies and allies combined. One
of the reasons often overlooked was the setting up of
American standards by the War Production Board in
the form of simplification orders. The first 75 of these

(Continued)

### EDITORIAL VIEWPOINTS, continued

issued in 1942 saved 600,000 tons of steel, 17,000 tons of copper, 227,000 tons of wood pulp, 35,000 tons of solder,180,000,000 yards of cotton cloth, 450,000,000 board feet of lumber. More important in today's emergency is that because of these standards at least 10 percent more manpower was released from unessential activity to war production.

Fortunately, all of the experience accumulated by the cooperating committees of the American Standards Association is today available for the use of government and industry. This great organization fostered and supported over the years by the engineering societies and farsighted firms in American industry now

stands ready to serve the nation's needs.

### Sulphur Scarcity Threatens

Some fundamental work on new methods for making sulphuric acid and for sulphur recovery seems to be urgently needed just now. Certainly something must be done to increase the supply either of sulphur or of sulphuric acid made without elemental sulphur.

Well known, but not formerly economic, are the processes for making acid from gypsum or anhydrite. A careful economic review of these processes with a hope of lowering costs seems definitely needed. Equally appropriate will be a restudy of all the sulphur reclaiming processes which are available. Present acid prices may justify such new methods for both virgin

and byproduct acid.

Even more desirable may be a development of elemental sulphur from new sources. Reclaiming from crude petroleum, from sour natural gas, and from other fuel sources, gives prospect of becoming profitable. The sulphur in motor gasoline used in the United States may equal 30 to 40 percent of the tonnage of sulphur required here. There would be large economic advantage in getting this impurity out of the motor fuel, for the octane rating desired could be obtained much more cheaply in the absence of sulphur. And certainly, the time has passed when great quantities of hydrogen sulphide should be burned in

flares instead of used for either acid making or sulphuric recovery. It might even be that use of this present waste will repay much if not most of the cost of taking the impurity out of the gas.

Some engineers believe that these new methods are not really needed. They say that perhaps we shall find new sulphur deposits which can be mined by the Frasch process. Only if so can we continue to depend on natural brimstone. But the drilling which has been done so far in salt domes, where sulphur has been suspected, is quite discouraging. In any event, it is safe to say that the threatening scarcity of sulphur fully justifies careful reappraisal of every sulphuric-acid source, in order that American industry may continue to have its largest single chemical raw material at the lowest possible cost.

### Ammonia vs Medical Science

Before the synthetic ammonia plant was built in Calgary, our Canadian friends in Cominco were prepared to accept the medical profession's theory on what causes twins. The doctor's statistics showed that on the average one out of every one hundred births brings twins. But for some strange reason the ratio of twins to the number of single births in the Alberta nitrogen department has risen to one in fifteen. That's a lot of twins. The younger married couples are getting worried. They are about convinced that "the ammonia duz it." Prospective fathers are pleading with the ammonia operators to remove even the last traces of impurities from their 99.99 percent product. One wife insists that her husband carefully wipe off his feet each night before leaving the plant just on the chance there may be some lingering trace of the naughty nitrogen.

Not wishing to shatter the faith of his fellow Cominconians in their fearful theory, the editor of the Cominco Magazine points out that the rate of twin production at the company's other ammonia plants at

Trail, B. C., is just about normal.

All of which reminds us of the old darky who claimed he almost died because a certain chemical company was letting so much "new-'monia'" loose in the air over Belle, W. Va.

### Volume 58-Chemical Engineering-Number 1

Chemical Engineering, with which is incorporated Chemical & Metallurgical Engineering, is the successor to Metallurgical Engineering, which in turn
was a consolidation of Electrochemical &
Magasine, effected in July 196.

The magasine was originally founded as
Electrochemical Industry, in September
1982, and was published monthly under
the editorial direction of Dr. E. P. Roeber.
It continued under that title until January
1965 when it was changed to Electrochemtion it was changed to Electrochemtion of Metallurgical Industry. In July
1964 the consolidation was made with
Iron & Steel Magasine which had been
founded sight years previously by Dr.
Albert Sauveur. In January 1916 the title
was changed to Metallurgical & Chemical
Engineering, and semi-monthly publica-

tion was begun Sept. 1, 1915. On July 1, 1918, the title was changed to Chemical & Meinilurpical Engineering and weekly publication was begun Oct. 1, 1918. Monthly Bellocation was segum Oct. 1, 1918. Monthly 1918. The 1918 the words "4 Meioliurpical" ware dropped from the main title to bring its name more in keeping with the editorial content.

Dr. B. P. Roeber was editor of the paper from the time it was founded until his death Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Dr. Parmulee assumed other responsibilities in the McGraw-Hill Publishing Company and Sidney D. Kirkpatrick was appointed editor. Dr. Kirkpatrick was named editorial director July 1, 1949, and at that

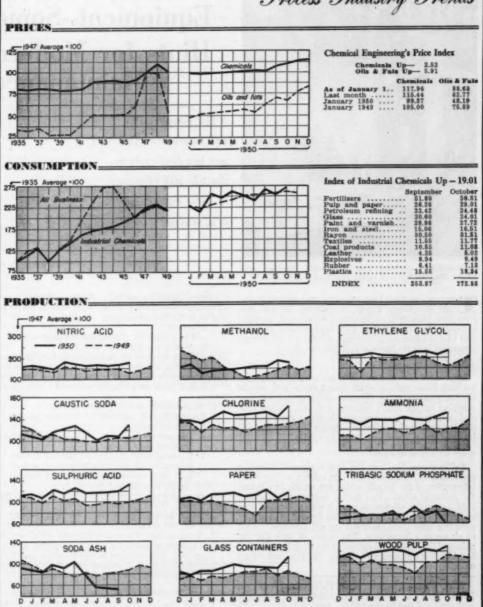
time he was succeeded as editor by John R. Callaham.

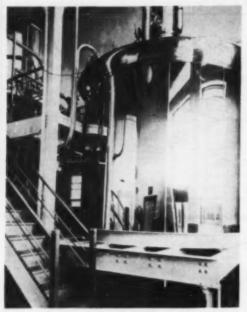
The present editorial staff of the magasine comprises, in addition to Dr. Rirkpatrick and Mr. Callaham: L. B. Pope, managing editor; T. R. Olive, senior associate editor; C. H. Chilton and R. L. Demmerle, associate editor; Goseph A. O'Connor, news editor; Morgan M. Hoover, Margaret Redfield and R. V. Reeves, assistant editor; Frances Arne, editorial sussistant editor; Associate Redfield, Prances Arne, editorial sussistant editor; C. C. Byrnes, Chicago; R. S. McBride, Washington.

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DEPARTMENT OF THE MONTH. This department appears in each issue among the ads. Are you using it? To call it to your special attention we are featuring it here this month

# Process Industry Trends





Well-cared-for nickel-clad steel brew kettle, sheathed with Monel, illustrates result of regular inspection and cleaning.

THE LAST few years have seen clad steel equipment become increasingly popular in industry; the next few years with indications of tightening supply and shortages of nickel, stainless, and even steel itself, promise to make your clad installations increasingly valuable. Your present equipment deserves the best care you can give it.

### IMPORTANCE OF CARE

High-nickel-alloy clad and stainless-clad steel equipment has hard, dense, surfaces which cannot slip or peel, remain absolutely unmarred by vigorous scrubbing and frequent polishing (except highly polished surfaces). When your clad surfaces have that characteristic silvery appearance of stainless steel or nickel, it means they're free from dirt and iron rust streaks which might lead to trouble.

### WHAT TO WATCH OUT FOR

Public enemy No. 1 of clad steel equipment is surface contamination. Deposits of foreign matter, or any other interruption of the smooth surface can constitute a potential source of attack. This foreign matter can sometimes hold a corrosive solution in contact with a localized area and thereby set up an ideal condition for contact or crevice corrosion (also called concentration cell corrosion). Lack of air causes a breakdown. The length of time and the nature of the deposit will determine the rapidity and extent to which the corrosion will advance. Stainless surfaces are especially susceptible.

E. H. WYCHE, a member of the Technical Service Dept., Lukens Steel Co., has had varied metallurgical experience with steel and non-ferrous metals. Previously, he was with U. S. Steel Corp., National Lead Co.

# Clad Steel Equipment—Some Hints for Modern Maintenance

A few simple rules and procedures that will pay big dividends in the life and efficiency of your equipment.

Surface contamination falls into the following specific categories. An awareness of the causes, with an eye to prevention, is the best advice here.

1. Iron rust:

E. H. WYCHE

a. From pipelines running above equipment.

b. At iron pipeline joints or outlets.

c. Tools dropped on surface during installation.
2. Collection of sediments, sludge or solid matter from process materials forming deposits at corners and offsets.

3. Splash spots above liquid level which subsequently harden.

4. Accumulations of film, grease and dust.

5. Evaporated and concentrated corrosive products.

6. Inaccessible areas:

 Equipment in contact with absorbent materials saturated with liquids.

Equipment in contact with wooden fixtures,
 Equipment in contact with graphite gaskets and

partially deteriorated rubber or fiber washers. Other things to watch out for:

 Be careful to prevent localized overheating on directfired vessels.

Don't use solutions in vessels for services which the vessels will not tolerate.

Avoid spillage of corrosive materials on carbon steel side of equipment unless the latter is adequately protected.

Never mark clad surface with implements or pencils containing graphite, zinc, or sulphur, particularly if the equipment is to be heated up to 300 deg. F. er over.

### ROUTINE CLEANING

A good rule: clean frequently and thoroughly. Clad steel equipment should be inspected regularly, cleaned

systematically and purged of all conditions that are apt to cause trouble. Most deposits can be removed more easily when they are relatively soft, before they have had a chance to harden. Just how frequently depends upon the nature of substances being handled and how often the equipment is used. Occasionally, processing operations are arranged so that there is no time for shut-downs and thorough cleaning. Instead only a few minutes are provided between the emptying and refilling of a vessel. Under such conditions it is helpful to rinse the vessel thoroughly with water; or, if particles tend to adhere stubbornly, a stream of hot water directed against the clinging mass is usually effective. Rinsing may not completely clean the surface, but at least it will minimize the accumulation of heavy coating or layers.

Soap and water, bristle brush scrubbing, fine pumice, solvents (naphtha, alcohol, acetone, ether, carbon tetrachloride) and reputable cleaners can be used with safety.

Better than soap are some of the new commercial detergents. These will not leave water stains and are superior for removing grease.

Ammonia, washing soda, borax, and similar materials are also good cleaming agents. Wire brushes should be made of stainless steel. Start off with simple methods and resort to harsher methods only when necessary. Experiment with a small area first if in doubt.

Sandblasting is sometimes useful for removing surface iron, scale, weld flux, but sand must be iron-free. Flinttype sand is recommended. If the surface is to be polished, it is best to use an iron-free wire brush or grind.

### CLEANING STAINLESS-CLAD STEEL SURFACES

Nitric acid solutions will not harm unpolished stainless steel surfaces. A 10-20 percent solution (made up in paste form with glycol for safety in handling) is usually sufficient to dissolve mineral deposits. More dilute solutions may be effective for dissolving iron stains. Loose iron can be removed by swabbing down with 5-10 percent nitric acid by volume at room temperature. Wash off with clean water. Warning: no fittings of carbon steel, brass, copper, bronze, nickel or any other material which is soluble in nitric acid should be allowed to come in contact with this acid. Even a brief contact with nitric acid is detrimental to such parts. Protection for skin, eyes, clothing should be provided.

The following alternate solution can be used for pickling

and removal of scale from stainless-clad surfaces: Sulphuric acid (commercial, sp. gr. 1.84)—10 parts by weight

Rock Salt-7-10 parts by weight Water to make-100 parts by weight Operating temperature 150-160 deg. F.

This solution is very strong, quite rapid in action and should only be used with extreme care. Thorough washing with clear water should follow.

Proper safety precautions should always be observed. Some solvent and acid fumes may be toxic if breathed in confined spaces. Here again protection for skin, eyes, clothing should be provided.

### CLEANING NICKEL, INCONEL AND MONEL-CLAD STEEL

For removing loose iron from the surfaces of nickel-clad, Inconel-clad or Monel-clad vessels the following procedure will be useful:

Hydrochloric acid (20 deg. Bè.)-31 cc. Ferric chloride-42.5 g. Water-1000 cc.



Neglected interior of stainless-clad steel autoclave shows black deposit of concentrated chlorides which pitted metal.

Caution: this solution should be used cold and not left in contact with the surface for more than an hour since its action is rapid. Thorough rinsing should follow.

Whereas the above solution is not as toxic as nitric acid, proper safety precautions nevertheless should also be followed with it to protect skin, eyes and clothing from the acid.

### CLEANING POLISHED SURFACES

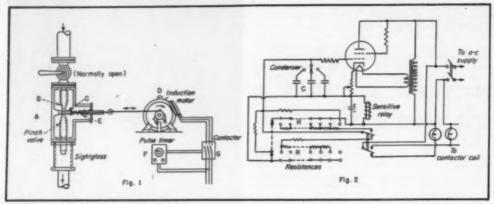
Where surfaces have been polished, the above methods should not be employed. A paste made with either magne-sium oxide or finely powdered pumice can be used for extremely fine polishing action. Such an abrasive, experimenting with a small area first, should usually prove effective. If a stronger abrasive action is needed, iron-free emery of 180 grit, lubricated with kerosene or lard oil is recommended. A 5-10 percent nitric acid solution, with 1-2 percent sodium bichromate to prevent discoloration, also can be used. Since polished surfaces are highly corrosion resistant, any cleaning of such surfaces, is largely desirable only from an appearance viewpoint. Fingerprints, smears, grime and soot on highly polished surfaces are regularly removed by ordinary solvents such as naphtha, gasoline, a good detergent or simply soap and water. A

hot water rinse will assist drying to prevent water staining.

Use liquid or other metal "polishes" with extreme caution. The foregoing methods should prove more than

Well-built, carefully finished clad steel equipment reflects sound materials, design and workmanship and deserves the little care necessary to keep it on the job. It will then be a constant source of profit to the user.

# The Plant Notebook Edited by Theodore R. Olive



Solid suspensions that tend to clog valves when throttled at a small rate of flow can be handled without plugging by control of

the average rate of flow, using a timed open-or-shut valve. Fig. 1 shows valve and actuator, Fig. 2 a satisfactory timer circuit.

### How to Control Average Flow of Liquids Carrying Solids

R. C. Bieber, Instrument Engineer, Lonza Ltd., Visp, Switzerland.

### \*November Contest Prize Winner

It is a common difficulty to find that ordinary valves tend to clog when used to throttle the flow of suspensions. In one of our plants it is necessary to control a small continuous flow of a catalyst suspension. We overcame the problem of valve plugging at small flow rates by interrupting the flow periodically and controlling the average rate of flow, rather than the instantaneous rate. The catalyst suspension is fed by gravity to a well agitated reaction kettle which is large enough to prevent noticeable cycling with the discontinuous introduction of catalyst.

Fig. 1 sketches the arrangement. The small, shop-made pinch-valve A makes use of a short piece of rubber tubing B (\frac{1}{2} in. O.D. in our case). The valve plug C opens the valve completely when the induction motor (or solenoid) D is energized. The plug is returned by spring E and the valve closes tight again as soon as the motor is de-energized. An induction motor of the very slow turning type which

can be mechanically stopped under full load without burning out is particularly convenient.

In order to control the average flow from 0 to 100 percent, the valve must be opened and closed periodically in such a way that the ratio of "on" to "off" time can be changed conveniently while operating. This can be established by a conventional cycling timer F (pulse timer) of the mechanical or the electronic type. This controls motor D by use of a high-energy contactor G. We have operated both types.

A simple yet satisfactory electronic circuit is shown in Fig. 2. It is based on the well known principle of periodically charging and discharging a condenser C through a set of resistances R in the grid circuit of an electronic relay. This timer has the advantage that the length of the overall cycle, although adjustable to the process by varying the capacitance C, can be kept fairly constant while the on-off time ratio can be altered conveniently by a single multi-point switch which adds or subtracts series resistance. By properly selecting the values of these parts very close control may be gained.

Since the liquid moves freely through the completely open valve during "on" periods, deposits of solids are stripped off, thus keeping the valve clean.

\* DECEMBER PRIZE WINNER-A \$50 prize will be issued to . . .

> NIELS MADSEN Chemical Engineer Elizabeth, N. J.

. . . for an article explaining a method of estimating the viscosities of liquid mixtures, and describing a simple instrument to enable this estimate to be made quickly and accurately. As winner of our December contest, this article will be published in our February issue.

\$50 PRIZE FOR A GOOD IDEA-Until further notice the editors of Chemical

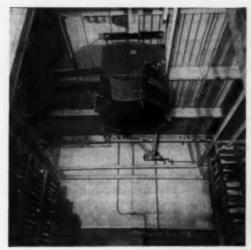
Engineering will award \$50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the January winner will be announced in February and his article published in March. Judges will be the Editors of Chemical Engineering. Non-winning articles submitted for this contest will be published if acceptable at space rates.

HOW TO ENTER CONTEST-Any reader of Chemical Engineering, other

than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300. words, but illustrated if possible.

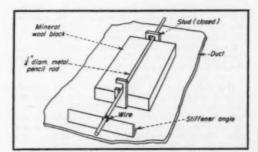
Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, sovel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St. New York 18. N. Y.



### New Use for a Unit Heater

In going into production on a new drug a large New Jersey pharmaceutical manufacturer needed to increase drying oven capacity materially. The existing equipment consisted of seven drying racks in cabinet type dryers, heated with steam coils. Temperatures above 160 deg. F. could not be secured, and air movement was limited.

In order to isolate the heat of the dryers from other departments they had been installed in a masonry-walled room 17 x 25 x 16 ft. high. A simple solution to the problem, which increased the drying capacity by 500 percent, was to make the entire room the dryer by adding a single Wing turbine-driven unit heater with a revolving four-way discharge, suspended from the ceiling. Temperature is held automatically at 210 deg. F. and is readily kept uniform throughout the space by the high level of air movement produced by the turbine-driven fan. Incidently, to have used an electric motor would have required installing it outside the room on account of the high operating temperature.



### Internal Insulation Cuts Cost of Hot Air Buct Maintenance

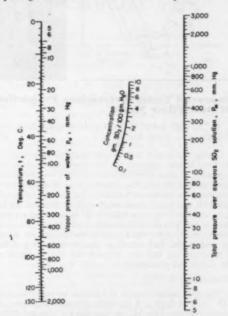
At the 300,000-kw. Sewaren generating plant of the Public Service Electric & Gas Co. of New Jersey, insulation is applied to hot air ducts in an ingenious way which reduces the possibility of expansion cracks and accidental damage. These large ducts handle secondary air at 660

deg. F. The special internal insulating technique reduces maintenance to the extent that inspection of the insulation lining is needed but once a year.

The insulation consists of mineral wool blocks secured inside the ducts by the arrangement shown in the sketch. Open rectangular studs are welded to the inside duct surface on 12-in. centers, with the blocks fitted between them and tightly butted together. Long metal pencil rods are inserted in the stud openings over the insulation, after which the studs are closed to hold the rods securely against the blocks. At 24-in. intervals, midway between alternate rows of studs, stiffener angles are welded to the duct. The blocks are painted with a waterproof coat to prevent moisture absorption during the application of a cement coat. Then expanded metal lath is wired to the pencil rods as a key for a 1-in. layer of refractory cement.

### How to Increase Pallet Life

Wooden pallets can be strengthened greatly, it has been pointed out by the Signode Steel Strapping Co., by tensioning bands of steel strapping around the pallets, and stapling the straps in place. The bands should encircle the pallet completely, over the pallet top, and under the runners. Such reinforcement prevents the nails from pulling out, holds boards tight to the runners, prevents distortion due to dropping on the corners, and prevents boards from splitting. The treatment is said to double pallet life.



### Nomograph Gives Solubility of Sulphur Dioxide in Water

D. S. Davis, Department of Chemical Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

The most satisfactory correlation of the great volume of data that deal with pressure-temperature-concentration relationships for aqueous solutions of sulphur dioxide is given in a recent paper by Plummer who proposed the equation log  $P_m = a + b \log p_w$ , where  $P_m =$  total pressure over the aqueous solution;  $p_w =$  vapor pressure of water at the same temperature, and a and b depend upon concentration. Plummer<sup>a</sup> reports reliable values of a and b for concentrations of 0.03, 0.05, 0.08, 0.10, 0.15, 0.50, 1, 2, 3, 4, 5, 6, 8, and 10 grams of sulphur dioxide per 100 grams of water, but there is evident need for a convenient graphical presentation of solubility data such that total pressures can be read for any concentration and temperature within the scope of the correlation.

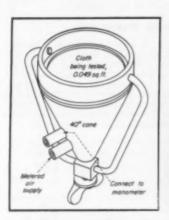
The use of the accompanying line coordinate chart, based on the published values of a and b and constructed by methods described previously, is illustrated as follows: What are the partial pressures of water vapor and sulphur

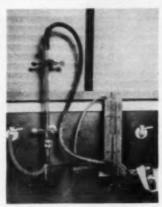
dioxide, and the total pressure, over a solution that contains 3 grams of sulphur dioxide per 100 grams of water at 30 deg. C.? Connect 30 on the t scale with 3 on the concentration scale and read the total pressure as 307 mm. of mercury on the P<sub>m</sub> scale. Opposite 30 on the t scale read 32 mm. as the partial pressure of water vapor. Subtract 32 from 307 to obtain 275 mm. of mercury, the partial pressure of the sulphur dioxide.

The average deviation of total pressures read from the chart from those reported in the International Critical Tables is less than 2 percent.

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 Davis, D. S., "Empirical Equations and Nomography," Chap. IX, McGraw-Hill Book Co., New York (1943).
 Plummer, A. W., Chem. Eng. Progress, 46, 369 (1959).





### Improved Tester Determines Properties Of Bust Filter Media

L. R. MICHELS and C. A. WOLBACH, National Lead Co., Titanium Div., Perth Amboy, N. J.

During the course of dust and liquid filtration studies, the need became apparent for laboratory apparatus for the evaluation of dust retention characteristics and air porosities of various fabrics. The apparatus used most extensively at present for testing air porosities of cloth is the Frazier\* tester. It was found, however, that this tester had limitations when used on very tight cloths because the air flow rates at low pressure differentials were too low for good measurement. Also, the Frazier tester afforded no means for testing the dust retention characteristics of a cloth. A more versatile unit was designed and used as shown in the sketch and photograph.

### HOLDER CONSTRUCTION

The cloth holder consists of a hollow bronze cone, 3 in. I.D.  $\times$  3½ in. high  $\times$  ½ in. thick, with a 40-deg. taper. A bronze ring also 3 in. I.D.  $\times$  ½ in. thick is clamped to the open end of the cone by tightening the thumb screw. The cloth to be tested is held firmly in place between the ring and cone by ½-in. thick rubber gaskets cemented to the flanges. Two ½  $\times$  1-in. nipples screwed into the cone provide the means for adding compressed air and determining the pressure drop across the cloth. The effective cloth area is 0.049 sq. ft.

Compressed air, properly throttled and adjusted for a range of 1 to 22 cfm./sq. ft. of cloth (as measured on a calibrated rotameter) is passed into the holder. Either an inclined draft gage for low differentials or a vertical U-tube for high differentials is used for measurement of the pressure drop.

All parts of this new tester were readily available and the cloth holder can be fabricated in any machine shop. The entire equipment, including a small portable compressor, can be easily moved to any location.

Cloth porosity is determined conveniently by either of two methods: In the first, the differential across the cloth is adjusted to 0.5 in. of water (as is used on the Frazier Tester) and the reading of air flow is obtained directly on the rotameter. In the alternate method, the air flow is adjusted to 20 cfm. per sq. ft. of cloth on the rotameter and the water differential read directly from the in-

clined draft gage or U-tube. The latter method has been found to be more accurate when tight cloths are tested.

To determine the dust retention characteristics of a particular cloth, a weighed quantity of the dust is placed inside the cone, following which the air flow is adjusted to 20 cfm./sq. ft. (or any desired value). A dust cake is formed on the cloth by inverting the cone and the degree of dusting quickly determined by tapping the cloth from the outside.

For the evaluation of cloths considered for a Herseytype dust collector utilizing blowback air, the open end of a ½-in. I.D. rubber tube supplied with air at 1 to 2 psig. is passed along the outer surface of the cloth.

Pressure differentials across cloth samples have been found to depend on the air flow and on the amount, degree of packing and agglomerating characteristics of the particular dust under consideration.

This cloth tester has been found to be of particular value in determining which cloth samples are the most promising for consideration in dust filteration. It has also been valuable in the quality control of filter fabrics in making sure that particular grades of cloth are the same at all times. The cloth tester has also proven a valuable tool in the calendering of cloths to any desired porosity.

In summary, a cloth tester has been developed which has been of great value for quality control of filter fabrics, for the evaluation of cloth porosities, for the determination of dust retention characteristics of various cloths, and the reduction of trial-and-error in the selection of cloth for dust filtration.

\*Schiefer, H. F., and Boyland, P. M., Jour. Research, U. S. Bureau of Standards, 28, 637-642 (1942).

# SOLVENT EXTRACTION **OILSEED**

There are many excellent articles and bulletins on the subject of solvent extraction of oilseed. But they are either too short for comprehensive coverage or are devoted to the full details of single processes. This report brings together the loose ends for a bird's-eye view of solvent extraction applied to oilseed.

E. P. COFIELD. JR.

### CHEMICAL ENGINEERING REPORT-JANUARY

THE MAJOR components of sced are oils, proteins, carbohydrates, crude fiber, moisture, and inorganic matter. There are also minor, though in many cases important, constituents such as pigments, vitamins, antioxi-dants, and enzymes. In general, the protective coating of a seed consists largely of carbohydrates and crude fiber, while the major components of the meat are proteins and lipids.

Lipids, classified in Fig. 1, are important from

the viewpoint of the oil mill operator since, while the simple lipids consist almost entirely of oils, the more complex lipids must be separated from these oils if marketable products

are to be obtained.

Oils are

Vegetable oils are rather complex mixtures of glycerides glycerides (glyceryl esters of various fatty acids). Oilseeds of commercial importance contain only very small quantity of waxes (esters of long chain, monocarboxylic acids and long chain alcohols). These waxes must be removed from certain edible products, principally salad oils. presenting a refining problem.

Of the three main types of complex lipids portions (Fig. 1), the glycolipids (fatty acid derivatives of the carbohydrates) and the derived lipids (hydrolytic products of the glycolipids and phospholipids) are important only because their presence in a vegetable oil is undesirable. Therefore, these components should be left behind in any extraction process.

In contrast, the phospholipids (glycerides in

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which one fatty acid residue has been replaced by a phosphoric acid residue—which in turn has been esterfied with a hydroxyamine) are of considerable value although they are present in

Proteins are not oil soluble, and therefore form a goodly share of the residue from any extraction process. Heat in certain extraction processes causes a complicated series of irreversible reactions; referred to as denaturing or cook-

Carbohydrates are also insoluble in oil, and so form a part of the residue.

CHEMICAL REACTIONS OF GLYCERIDES

Oxidation is of extreme importance in the Oxidation edible oil and drying oil fields. In the case of is good edible oils, and to a somewhat lesser extent for and bud those oils from which soaps are derived, the point is to prevent oxidation. On the other hand, the properties which make the drying oils important are directly related to their ability

The edible and soap-making oils are those which have greater proportions of more nearly saturated fatty acids. The unsaturated fractions present tend to oxidize to form aldehydes. ketones, acids, hydroxy acids, etc. (turn rancid).

The drying oils contain greater proportions of unsaturated acids. As oxidation proceeds in these oils, the molecules polymerize to form tough films.

Hydrolysis of glycerides to form glyerine and So is fatty acids will occur in the presence of mois- hydrolysis ture alone. However, the reaction is catalyzed by mineral acids, alkalis, and certain enzymes. Its rate increases with temperature. Hydrolysis is deliberately induced to make soap, and prevented as much as possible otherwise.

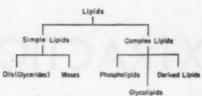


Fig. 1-Classification of Lipids.

Hydrogenation is of no particular interest to the oil mill operator, but is used to convert unsaturated vegetable oils into shortenings and

Dehydration is important, notwithstanding the fact it is applied only to oils (mainly castor) which contain rincinoleic acid. This acid differs in that it contains a hydroxyl attached directly to a carbon atom. Dehydration can be used to increase the degree of unsaturation by splitting off this hydroxyl group with a hydrogen atom to form a double bond. By doing this, castor oil can be converted to a reasonably good drying oil.

### Preliminary Operations

All oilseed goes through the following preliminary operations, regardless of whether mechanical expression or solvent extraction is to be used. (Exception is heat treatment, when meal from the solvent extraction process is to be used for industrial rather than feed purposes. In this case, only a mild heat treatment is

Care with which seeds are handled has a direct bearing on the quality of oil produced. As mentioned previously glycerides tend to hydrolyze more rapidly in the presence of certain enzymes. Apparently these enzymes are activated by bruises and cuts, increasing the free fatty acid content. Further, brown pigments are often found in oil from damaged seed,

lowering the quality.

Seed is usually cleaned prior to storage to eliminate substances that might cause heating in storage. Foreign material includes dirt, stones, mudballs, sticks, leaves, and scrap metal. Combinations of sieves, screens, air separators, and magnets are used. Magnets are commonly used throughout the process, to prevent stray pieces of iron from damaging machinery.

Oilseeds being highly seasonal crops, storage periods vary considerably. Such storage is no problem if seed is sound and moisture content adjusted, if necessary. Critical moisture content varies with seed-Ilpercent is the maximum for cottonseed. Deterioration increases the temperature of the mass which in turn speeds up

the rate of deterioration.

Frequently hot air or flue gases are circulated for drying. A cooling system is normally an integral part of each drier. In drying soybeans, for example, the beans leave the drying unit at 180-200 deg. F., then are immediately cooled to 80-90 deg. F. to Cottonseed warehouses frequently have duct systems to cool the mass if it gets too warm.

Since the oil content of the hull is usually Hulling quite low (usually less than 1 percent) and since its tough fibrous nature would interfere with extraction, hulls are usually separated from the meats. Exceptions are very small seeds where separation is uneconomical, and frequently soybeans whose hulls make up a comparatively

minor portion of the whole seed.

Decortication is usually done with bar or disk hullers, followed by separation. Separation is desirable since (1) the hulls would reduce the oil yield by absorbing a considerable por-tion and (2) presence of hulls requires processing a comparatively large quantity of low oil content material.

Ease of separation varies with type of seed. Those having meats with little adhesion to hull fragments (e. g. tropical units) can be separated simply by using rising conveyor belts or brine flotation. The majority of devices used for separating medium-sized seed contain either vibrating screens or air lifts, or both.

Most efficient extraction usually requires the Million size of the seed be reduced. With smaller seeds, milling also removes the hull, but no separation is made. Type of mill and the size and shape of the ground particles are largely governed by the processing method which is to

Preliminary heat treatments increase the effi-ciency of the oil extraction process. Treatment varies even more widely with extraction method

than does the milling operation.

### Basic Principles of Solvent Extraction

Consider the oil to be contained in small, tough-walled cells which are scattered throughout the meat of the oilseed. A portion of the oil is freed from these cells during the milling operation, and this portion immediately dissolves in the solvent. However, at this stage the bulk of the cells are intact, so that the greater part of the oil is not in direct contact with the

Oil is removed by diffusion of solvent and oil through the cell walls which continues until equilibrium is reached. If the solution outside the cell walls is replaced by solvent with lesser

oil content, the diffusion process is set in motion again. Economic limit to this procedure is about 0.5 percent oil remaining in the seed mass.

With free circulation of the solvent, the rate of diffusion is directly proportional to the surface area of the seed particle and inversely pro-portional to its thickness." Accordingly, oil-seeds are usually converted to flakes before extraction.

Application of the above principles has been slow. They are being applied to the newer types of extraction equipment, with increased

### **Batch Solvent Extraction Methods**

Batch methods have these advantages: fairly low initial investment; can process as little as 3 tons per day; are suitable for intermittent operation.

On the other hand labor costs are high,22 and high vapors which are flammable or toxic or both may be released when the extractor is open.

Although batch extraction of oilseed is widely used in Europe, commercial use here is limited to castor beans. Batch extraction has been widely used in pilot plant studies of many contiuous processes.

The rotary-type or percolator extractor is widely used to extract oil from the pomace resulting from the cold hydraulic pressing of

castor beans. A typical extractor is a large horizontal drum mounted on rollers. Inside is a horizontal, perforated, metal strainer covered with a filter mat of burlap, which extends the length of the drum and divides it into two compartments. One compartment is smaller than the other. The large compartment receives a charge of 10-12 tons of solid material and 4,000-5,000 gal. solvent, which are mixed by rotation of the drum. Then solvent is allowed to drain into the smaller compartment by gravity, from which it is continuously pumped during the drainage period. Five to seven ex-tractions reduce oil content of the caster pomace from about 15 to 1.5 percent.

### Continuous Solvent Extraction Methods

The continuous extractor is a logical development of batch methods using the principle of countercurrent solvent flow. The first continuous extractor was introduced in Europe on a commercial basis in the early 1920's. Since that time possibly a dozen systems have been offered to the oil extraction industry.

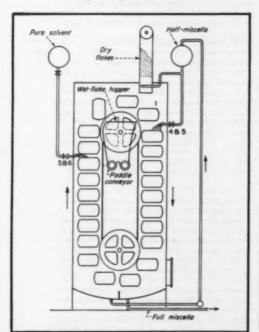
All of these can be considered as employing the same four operations: preliminary processing of the oilseed, extraction of the oil from the oilseed by means of suitable solvents, separation of the resulting miscella into solvent and oil fractions, and separation of the solvent from the comparatively oil-free residue.

### MAJOR GERMAN-DESIGNED UNITS

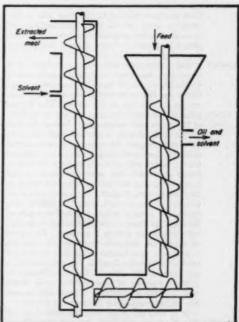
Two systems of German design and manu- Two facture, the Bollman and the Hildebrandt, are syste of considerable importance from both a historical viewpoint and on a basis of units now

BOLLMAN SYSTEM

The Bollman or basket-type system was developed by the Hansa-Muhle Co. of Germany, which was originally a processor of oilseed. However, during the 1930's this company began to offer a design and installation service which was continued until interrupted by World War



**BOLLMAN EXTRACTOR** 



HILDEBRANDT EXTRACTOR

II. One of the most notable installations of this system, in Hamburg, had a capacity of 1,000 tons of seed per day, while two installed in the U.S. had a combined capacity of 900 fons.

Insofar as is known, the original Bollman units in use in this country are restricted to the processing of soybeans. However, certain modified Bollman units, which will be discussed, are also used for cottonseed and flaxseed. In 1948 about 75 percent of the sovbean extraction capacity of this country was supplied by basket-type (Bollman or modified-Bollman) extractors.

The heart of the Bollman system is the bucket-type extractor. One of the two Bollman extractors operating in the U. S., that of the Central Soya Co. of Decatur, Ind., is described

as follows:18

Two

solvent

possages

"The Bollman system of extraction gives two passages of solvent through the beans, fresh solvent in the countercurrent and half miscella in the concurrent direction. The half miscella is the product of the extraction by the fresh solvent sprayed on the partially extracted flakes as they rise through the up side of the elevator system of the extractor. The half miscella, sprayed on the fresh flakes as they enter the extractor, flows through on the down side to yield the full miscella, from which the oil is obtained by evaporation of the solvent.

The Bollman-type extractor used by Central Soya carries 38 baskets, each 61 ft. long, 28 in. wide, and 21 in. deep. At the loading, or No. I position, are set spray pipes in position to wet the flakes with half miscella as they enter the basket. Beside and slightly above positions 4 and 5 on the down side are perforated pipes (in fixed positions parallel to the long axis of the baskets) from which half miscella can be sprayed. Similar spray units for fresh solvent are placed in positions 5 and 6 from the top on

the rising side.

The entire extraction unit is housed in a vapor-tight, fabricated steel tank, approximately 45 ft. high and 15 by 8 ft. in cross-section. Flakes are fed in through a vapor-tight double hopper on the top of the tower. The hopper gates are operated by cams on the main shaft of the extraction tower drive. When the first hopper is filled with a set load and dumps to the second hopper, the upper gates immediately close and the lower hopper dumps into the extractor basket just as it starts down the tower. Directly beneath the zenith position in the basket train is a bin for receiving wet flakes as they are dumped from the top basket after completion of the extraction cycle. Paddle conveyors run from this bin out opposite side of the extractor tower to steam-jacketed Schnecken conveyors where solvent is removed. The speed of the paddle conveyors from the wet flake bin is manually coordinated with that of the ex-tractor so that the level in the bin provides a seal between the extractor and the Schneckens.

The sequence of the solvent cycle beginning with the introduction of fresh solvent onto the partially extracted flakes is as follows: 1. A total of 96 gal. of fresh solvent at 136

deg. F. is sprayed from the automatically actuated system onto the two adjacent baskets of

partially extracted flakes in positions 5 and 6 on the up side each time the continuously moving elevator advances one position, at 58 to 60-sec. intervals; thus each basket of wet flakes is sprayed twice with fresh solvent. The solvent drips through the baskets below to the floor pan, where it is collected as half miscella. (There being very little additional hold-up by the already wet flakes, and some drainage from the baskets passing over from the down side, the total half miscella collected per 96 gal. of fresh solvent is about 120 gal., containing about 15 percent oil.) The half miscella is pumped flake particles which might clog the spray pipes, and then to a high tank where it is reheated to through a settling chamber to remove large 136 deg. F., and sprayed onto the down baskets.

2. As a basket is loaded with flakes it is Miscella sprayed with 30 to 35 gal. of half miscella, spray. which is sufficient to wet the load thoroughly As the hopper closes, the main spray valve opens and the sprays at positions 4 and 5 on the down side empty the remainder of the 120 gal. of half miscella on their respective baskets. This entire procedure is repeated each time the train advances one position.) The resulting full miscella is collected in the floor pan. (Here on the down side, starting with fresh flakes, there is considerable holdup and carryover, so that the amount of full miscella collected is about 65 gal. per 96 gal. of original fresh solvent.)

3. The full miscella, containing 25 to 28 percent oil, is pumped through leaf filters, then through a small surge tank to a heat exchanger (heated by the vapors of reclaimed solvent distilled from a falling film evaporator) and thence to the first evaporator, which it enters at about

145 deg. F.

There are a number of advantages to the Advan-Bollman system. These are: (1) agitation of the toges flakes while being extracted is held to a minimum. This allows the use of comparatively thin flake, with a resultant reduction in the extraction time required. (2) The solvent and flakes move together on the concurrent side. which forms the best filter so far developed for clarifying the miscella. (3) The power cost is low—a 1-hp. motor will operate a 250-ton extractor. (4) Solvent retention in the flakes is low. However channeling, which of course results in incomplete extraction of the flakes, occurs if the baskets are not properly filled.

HILDEBRANDT SYSTEM

The Hildebrandt extractor, like the Bollman, is of German origin. In addition to those in a number of plants in Europe, four Hildebrandt units are located in the U.S. One of these is of considerable historical importance, being the first large-scale continuous solvent extraction plant to be operated successfully in the U. S. In addition to this plant, which is the Archer-Daniels-Midland plant in Chicago, other Hildebrandt extractors are in use in the Glidden Co.'s plant (two units) also located in Chicago, and in the plant of the Clinton Industries, Inc., Clinton, Iowa. These units, with the exception of that in the Clinton plant, are used primarily for the extraction of sovbean oil, and have a

combined capacity of about 480 tons per day. The Clinton unit is primarily used for the extraction of corn oil from corn-germ expeller cakes, handling about 55 tons per day. When operated with soybeans its capacity is increased

to 75 tons per day.

The Hildebrandt extractor is a total immersion unit and, therefore, operates on a principle which is entirely different from that of the Bollman extractor. The extraction unit consists primarily of a U-shaped tube.30 The oleaginous material to be extracted is fed into the top of one of the legs of the U, after which it is propelled through the extractor proper by perforated screw conveyors. These conveyors are rotated at different speeds by means of a explosion-proof gearmotors, the rotation motions being controlled so as to produce considerable compaction in the bottom of the U. Guide rails are frequently provided in the ascending leg of the extractor as a means of preventing the charge from rotating. The solvent, usually hexane, is pumped through the extractor so that it travels in the opposite direction from that of the materials being extracted, thus producing countercurrent flow. The miscella, which is discharged near the point at which the oleaginous material enters the extractor, passes through a strainer to the solvent recovery apparatus, while the meal is removed near the point at which the solvent enters. The solvent is heated to about 120 deg. F. prior to being brought in contact with the oil-bearing matter and the ratio of solvent used to soybean extracted is roughly 1:1, on a weight basis. As is typical of a majority of solvent extraction processes, the oil content of the residual meal is about 1 percent.

AMERICAN MODIFICATIONS

Madified Bollman

Two modified Bollman-type extractors are currently being offered by American manufac-turers. These are the French Oil Mill Machinery Co. of Piqua, Ohio, and the Chemical Plants Div., Blaw-Knox Construction Co., Pittsburgh, Pa. Inasmuch as a rather detailed description of the operation of the Bollman extractor has already been presented, the following discussion of these extractors will be rather limited.

### FRENCH EXTRACTOR

French extractors installed in this country have a combined capacity of 5,743 tons per day, and are being used for the processing of soybeans, flaxseed, cottonseed and peanuts. According to the manufacturer, corn germs have been processed successfully at full plant capacity. Besides having all of the advantages which were cited earlier for the Bollman-type extractors, the design of the French extractor is such that channeling is held to a minimum.

### BLAW-KNOX EXTRACTOR

A number of Blaw-Knox extractors of the conventional basket-type have either been built or are now under construction. These include the 100-ton Allied Mills plant at Taylorville, Ill.; two plants for Spencer Kellogg and Sons, Inc., one each at Decatur, Ill., (500 tons) and

Bellone, Ohio, (380 tons); two 200-ton plants for the Ralston Purina Co. at Bloomington, Ill., and Iowa Falls, Iowa respectively; a 500ton plant of Archer-Daniels-Midland at Decatur, Ill.; a plant of similar capacity of Cargill, Inc., at Cargill, Ill.; and an 800-ton plant at Decatur, Ill., operated by the A. E. Staley Co. These plants have been used primarily for the extraction of soybean oil. But, according to the manufacturer, the extractor is suitable with slight modifications for the processing of cottonseed. However, the process is not believed to be suitable for peanuts.

### AMERICAN-DESIGNED EXTRACTORS

As has been indicated previously, the first Novel extraction units installed in this country were approaches of foreign origin, i.e., Bollman and Hildebrandt. However, a number of extractors of American design and manufacture have been developed, and many such units are now in operation. As will be seen from the following, a number of novel approaches to the problem of successfully extracting various vegetable oils have been incorporated in these designs.

### ALLIS-CHALMERS EXTRACTOR

The extraction unit developed by the Allis-Chalmers Manufacturing Co. differs in design and appearance from any of the extractors which have been considered previously. This extractor is of considerable importance, not so much on a basis of the total capacity of Allis-Chalmers units in use, but because the unit works quite well with materials which do not form good flakes. (The formation of a tough, nonfriable flake was at one time considered as a necessary prerequisite for successful solvent extraction.) Thus Allis-Chalmers units are being used to process a variety of oleaginous materials and, if the seed is suitably prepared, they can be used to extract peanut oil, linseed oil, and castor oil.

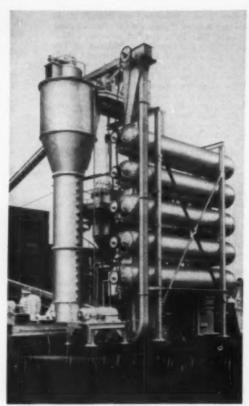
The operation of an Allis-Chalmers extractor (Delta Products Co., Wilson, Ark.) in processing cottonseed, at one time considered entirely unsuited for solvent extraction, is de-

scribed as follows:2

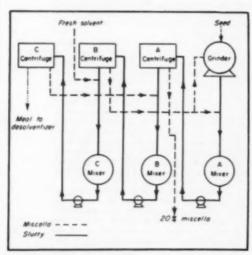
'The extractor, a vertical cylindrical column, Slotted is divided into compartments by means of a Plotes series of fixed horizontal plates. The upper surface of each plate is wiped by a scraper arm which is fastened to a slowly rotating central shaft. Two slots, diametrically opposite each other, are cut into the plates so that during each scraper rotation, the lowermost increment of flakes in any one compartment is dropped onto the plate below. The screw-type feeder provided at the top of the column also func-tions as a vapor seal. The top of the extractor is enlarged to serve as a settling chamber for the separation of any suspended flake material from the miscella rising in the column.

The cottonseed flakes are fed into the top of the extractor. While the flakes are being slowly propelled downward in the column, they are countercurrently washed with solvent. The solvent is pumped into the bottom of the column. Where it is deemed desirable to heat the solvent, use can be made of the heater

provided for that purpose.



ANDERSON EXTRACTOR



SHERWIN-WILLIAMS SYSTEM

"The solvent used is a commercial grade of hexane with an approximate boiling range of 147-158 deg. F. It is pumped from the solvent storage tanks through a water trap before being introduced into the extractor.

"As the flaked meats move downward in the column, their oil content is progressively reduced, while the miscella becomes richer in oil as it rises in the column. The miscella ultimately overflows near the top of the extractor while the spent flakes are carried away at the bottom by a discharge conveyor. Upon being elevated and then discharged into a squeezer mechanism, the extracted flakes, with most of the solvent squeezed out, are reasonably dry and ready for delivery to the meal driers."

### ANDERSON EXTRACTOR

The Anderson Extractor is manufactured by Compact the V. D. Anderson Co., Cleveland, Ohio. This unit extractor is somewhat similar to the Allis-Chalmers unit in that the unit is housed in a vertical column and the material being extracted travels downward through the column while the solvent flow is countercurrent. A further similarity between the two units is that the extractor column is divided into compartments by herizontal slotted plates which are cleaned periodically by rotating scraper arms. However, a novel feature embodied in the Anderson system is that the extractor and the solvent re-covery equipment is built into a compact unit designed for outdoor installation. The complete plant is run from an indoor control room which is located in the meats preparation build-

In order to facilitate the handling of oilseed having a comparatively high oil content, the V. D. Anderson Co., recently developed their Exsolex process in which a high capacity continuous screw press is closely integrated with the extractor.

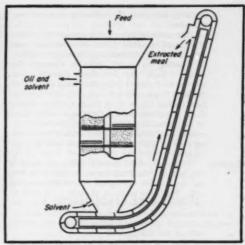
### KENNEDY EXTRACTOR

The Kennedy Extractor, named after its in- Versatile ventor, Angus B. Kennedy, and currently manufactured by the Vulcan Copper and Supply Co. of Cincinnatti, Ohio, is a rather versatile piece of apparatus capable of handling a number of oleaginous materials which are ordinarily considered to be quite difficult to process by solvent extraction methods. These materials include cottonseed, peanuts, castor bean flakes, tung nuts, flaxseed, and sunflower seed, in addition to that old standby, soybeans. 10 Further, no requirement seems to exist for the oil-bearing material to be in the conventional flake form, since extraction has been accomplished successfully on material that was either granular, powdery, gelatinous, fibrous, stringy, or pulpy in nature. A variety of solvents, including petroleum fractions, acetone, alcohol, trichloroethylene, and mixed solvents have been used successfully

The Kennedy extractor differs considerably from all of the extractors which have been described previously, as may be readily seen from the cross-sectional view and the photograph of the 100-ton extractor now in use in Abilene, Tex. In view of the many novel features of the



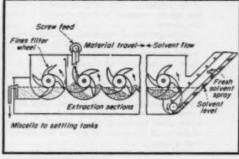
ALLIS-CHALMERS EXTRACTOR



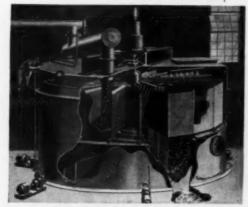
ALLIS-CHALMERS EXTRACTOR



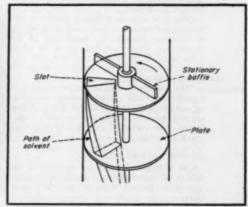
KENNEDY EXTRACTOR



KENNEDY EXTRACTOR



ROTOCEL EXTRACTOR



BONOTTO EXTRACTOR

Kennedy extractor, the following excerpts19 are

The continuous extractor consists of a series of enclosed extraction chambers or sections: into each of these is fitted an impeller wheel assembly for moving the solid materials through the liquid. Each impeller wheel assembly consists of an enclosed hub (the lower portion of the hub is partially submerged in the liquid), four curved blades of perforated metal, and a shaft extending through bearings in the sides of the extractor walls. The impeller wheel assemblies are driven from the outside by a common drive shaft through a worm and gear ar-

When the solid material being processed is required in flake form for extraction, it is first put through the corrugated rolls of the cracking mill. Next, the moisture content is adjusted to give the best flaking properties, and then the material is flaked to the desired thickness by passing it one or more times through the smooth

rolls of the flaking mill.

The material, reduced to the most suitable size for extraction, is placed in the feed hopper of the Kennedy extractor. From here, controlled quantities are fed at a constant rate by a feed screw conveyor into the first extraction section of the extractor. The material then is carried through the extractor in countercurrent flow to the solvent.

Each portion of immersed solid material in a section is collected by an impeller blade and carried through the liquid in that section. As the solids are carried up the curved wall of that section, they are slightly compressed between the wall and the curved blade to form a wedge, which is lifted above the liquid level and sloughs off the blade into the next section. This slight compression and draining, through lifting the solids above the liquid level, reduce the amount of entrained liquid carried over to the succeed-

Wedge

Crecking

On striking the liquid surface in the sucaction ceeding section, the wedge readily breaks up and disperses. The solids immersed in the liquid of this section as distinct particles are igain collected by an impeller blade and moved through the liquid.

"The cycle in each section of dispersion, immersion, and collection of the solid in the liquid, of movement through the liquid, and of the compression, lifting, and draining of the solids is the basis of the intimate and thorough contacting between solid and liquid for exhaustive

The extracted solids are gravity drained of a good part of the entrained solvent while being carried up the drag chain conveyor, and then are dropped into a collecting can with a perforated false bottom for separating additional liquid drainings.

### SHERWIN-WILLIAMS EXTRACTOR

extraction of solute.

One of the most recent developments in the field of solvent extraction is the extractor developed by the Sherwin-Williams Co. of Cleveland,

This extractor was specifically designed to process oilseed having a relatively high oil content, as such materials are normally quite difficult to process by more conventional solvent extraction methods.

The first deviation in this process from practices which have heretofore become more or less standardized is in the preparation procedure, where the material to be extracted is ground in the absence of a solvent. However, this is not the only novel operation embodied in this process, as may be seen from the following descrip-

tion of the extractor unit.12

"The extraction system consists of three units Gree in series. Each unit comprises a slurry mixer with and a continuous, solid bowl, Bird centrifugal solvent separator. Each unit is capable of extracting approximately 90 percent of the oil input to that unit when the solvent feed is adjusted to produce a final miscella of 20 percent oil content. With three units in the system, the input solids to the final unit carry only about 1 percent of the oil and the output solids from this unit retain only a few tenths of a percent of the oil. The mixers are specially designed horizontal cylinders 29 in. by 18 in. in which are mounted rotating shafts carrying a series of screw blades. This design of the mixers effects a forward movement of the solids and miscella, preventing back mix and allowing the prescribed amount of time for mixing of the solids and extracting miscella. A concurrent flow of miscella and solids is thus achieved in the mixers, while in the extraction system, taken as a whole, the miscella and solids flow countercurrently.

"The output of the grinding system is fed directly to the extraction system by gravity. The feed of seed materials to the extraction system is maintained at a uniform predetermined rate. The desired ratio of seed materials to solvent is maintained in the over-all extraction system by regulating the fresh solvent input to the system

to balance the seed input.

"The slurry pumps from each of the mixers Floor are controlled by floats placed in domes located control at the front end of each mixer. These controls, plus a flow control set at approximately 30 gpm. on the entering fresh solvent stream, govern the flow of slurries and miscellas throughout the extraction system. Fresh solvent entering the extraction system is heated by steam-heat-exchangers to about 170 deg. F. The first mixer, where solids enter the system, is steam-jacketed so that the proper operating temperature can be maintained. The final miscella from the first unit is practically clear and free from fines. As a safety precaution, however, it is first run through a clarifier, and the solvent and oil are then separated.

One other characteristic of the Sherwin-Williams extractor is worth noting. A heptane fraction rather than the conventional hexane cut is used in the extraction of castor oil, primarily because castor oil is not miscible with hydrocarbon solvents in the range of 80-100 deg. F. However, hexane is used when linseed oil is being extracted.

### ROTOCEL EXTRACTOR

The Rotocel extractor is a new unit recently developed by the Chemical Plants Div., Blaw-Knox Construction Co., Pittsburgh, Pa. Ac-

cording to the manufacturer, this extractor is a less complicated and lower-priced unit than the basket-type extractor marketed by the same company, and the results to date indicate that this extractor is far superior to anything heretofore made. At the present time, the Glidden Co.'s 250-ton plant at Indianapolis, Ind., and the 75-ton Soy-Rich unit at Wichita, Kan., are in operation.

The extractor itself is entirely enclosed in a cylindrical tank and consists essentially of a series of compartments which revolve about a central axis. As each compartment passes a predetermined spot, a load of oleaginous material is deposited therein from a feeder pipe. As the filled compartment continues to revolve, it is sprayed with solvent at intervals from overhead nozzles. The resulting mixture of solvent and extracted oil drains continuously through the mesh-type floor of the compartment and collects in troughs located in the lower part of the enclosing tank. At the completion of its circuit, the floor of the compartment opens, thus dumping the residual meal into a hopper. As soon as the floor is restored to its original position, the compartment receives another load of unextracted material, and the cycle is repeated.

### BONOTTO EXTRACTOR

The Bonotto extractor is somewhat similar to the Allis-Chalmers unit. However, as will be noted from the following description,1 as well as from the diagramatic sketch, there are certain essential differences between the two

models:

The Bonotto system of extraction consists primarily of a packed column of oil-bearing material through which solvent is forced in countercurrently. This column is confined in a cylindrical container kept continuously filled. The material in process is sub-divided into sections by means of a number of horizontal plates, the weight of solids in each section being supported by its respective plate. Specially shaped slots are cut in each plate, each slot being staggered from the next, in succession. A stationary baffle is fixed to the wall of the column above each plate. These plates are spaced ac-cording to the physical characteristics of the process material, and are fixed to an axial shaft, rotating at a slow speed.

"Fresh solvent enters the bottom, passing upward and out at the top after extracting the oil by diffusion, while the oilbearing material, with the free oil washed from it in its passage through the feeder-filter referred to below, enters

"Channeling of the solvent through the material is kept under perfect control by the creation of channels through the slots and their rotation around the axis. All particles of the material are contacted by the solvent under the same conditions, and no section exists where the solvent may remain stagnant or flow at uncontrolled speed.

"The stationary baffle above each plate prevents rotation of the material along with the

supporting plate.

These last improvements in the Bonotto column are in marked contrast to an early model, now abandoned, whereby the plates were stationary and the material was mechanically moved through the slots by rotating arms which created overagitation of the solids.

The design of the extractor provides high countercurrent speed of the solvent through a packed column of divided material, with continually changing channels created by the revolution of the slots in the plates. The material descends quietly from section to section by gravity, with a minimum of agitation.

"The feeder-filter is another outstanding new and exclusive feature of the Bonotto system. This apparatus consists of a filter conveyor carrying the fresh feed to the extraction column. Through this filter the miscella leaving the extractor passes countercurrently on its way to the settling tanks.

### SMALL-SCALE EXTRACTORS

All of the extractors which have been de- for the scribed previously have been relatively large in for size, the smallest having a capacity of about 50 tons per day. However, since the introduction of solvent extraction into this country in 1934, considerable interest has been evinced in the development of a small-scale extractor which could be operated economically by an individual farmer (or by a small group of farmers) to pro-cess his (or their) own produce. Such an

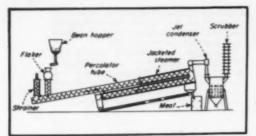
extractor would, of course, have to have a capacity of somewhat less than 50 tons and should utilize a non-flammable solvent, for obvious safety reasons. Three extractors which have been developed along these lines are described

in the following paragraphs.

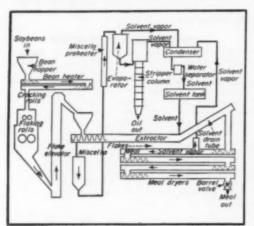
FORD EXTRACTOR The prototype of the small-scale extractors was developed by the Ford Motor Co. during the early 1930's, partially at least, in response to Henry Ford's interest in a program whereby the extraction of oil could be decentralized to the maximum.24 Another consideration in this development program was the anticipated use, in Ford operations, of soybean protein in the production of plastics, and of soybean oil for enamels and other protective coatings. Three Ford extractors having a combined capacity of 75 tons were eventually constructed and operated for a number of years. However, the operation of these Ford units was discontinued in 1946.

DETREX EXTRACTOR

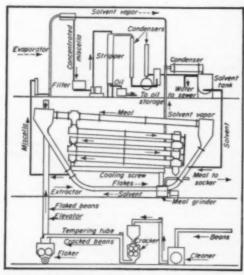
As indicated in the preceding paragraph, the Hon-Ford extractor used highly flammable hexane flow as the extraction medium. This difficulty has been overcome by the Detrex Corp. of Detroit, Mich., in the development of its small-scale extractor (25 to 200 tons capacity) through the use of stabilized trichloroethylene, a non-flammable solvent. The first Detrex extractor to be installed and operated on a commercial basis was the 10 ton plant of the Indiana Farm Bureau Cooperative, Inc., which went on stream in Danville, Ind., in 1944. Another extractor of similar capacity was placed in operation shortly thereafter by the Farm Bureau Cooperative Assn., Inc., Springfield, Ohio. Inas-



FORD SYSTEM



**DETREX SYSTEM** 



IOWA STATE SYSTEM

much as the operation of a plant of this size was found to be uneconomical, the capacity of the latter unit was increased to 25 tons the following year. Other installations employing the Detrex extractor are the Swift and Co. plant at Memphis, Tenn., and that of the Compania Anonima "Las Flores," Puerto Cabello, Venez-uela. All of these extractors are engaged in the exclusive processing of soybeans except that of the Compania Anonima, which is designed to extract either soybean or coconut oil.

As may be seen from the following description, the Detrex unit bears a superficial resemblance to the Hildebrandt and Ford extractors in that the oleaginous material is propelled through the unit by means of a screw conveyor.

"The Detrex oil extraction process consists of a flaker, extraction tube, miscella still, meal driers, and solvent condensers. The solvent used is a stablized chlorinated hydrocarbon which is non-flammable and non-explosive.

"Beans are fed directly to the bean heater, Make which does not materially affect their moisture plieble content but merely heats so that they become more pliable for flaking. After the cracking and flaking operations, an elevator carries the prepared flakes to the flake hopper, from which they are mechanically fed into the long ex-

Flakes are maintained in a loose condition while in this extractor tube, thereby allowing complete penetration of the solvent. Since the flakes are moved forward and constantly change their position, they come in contact with newly distilled solvent as they approach the discharge end of the extraction tube. These extracted flakes are drawn from the extractor tube by means of an inclined screw which allows the solvent to drain from the flakes prior to passing them into the drier tubes.

"Miscella flows from the extractor tube through a screening device and is collected in a surge or accumulation tank."

### IOWA STATE EXTRACTOR

Most recent addition to the small extractor Most field is that of the Iowa Engineering Experiment recent Station which has recently developed a 25-ton package unit,4 capable of being operated by comparatively inexperienced personnel. unit is similar to the Detrex unit in that it employs non-flammable trichloroethylene as a solvent, but differs in that the extractor section is a chain conveyor in a looped tube rather than a horizontal screw conveyor.<sup>5</sup> A pilot plant having a capacity of 15 tons (see diagram) has been in operation at Plainfield, Iowa, for the past several years; during which time soybeans, milkweed seed, cottonseed, oatmeal, and corn germs have been processed. On the basis of these experiments, soybean, milkweed, and corn oils were extracted successfully; however, the cottonseed oil was not of good quality, and processing difficulties were encountered in the extraction of oatmeal

The manufacturing rights to the Iowa State extractor were recently assigned to the Crown Iron Works, Minneapolis, and four units built by that concern are now either in operation or being installed.

## Separation and Purification of Products and Byproducts

In all of the extractors described in the preceding section, the oleaginous material is separated into two principal components, oil and meal. At this point in the process the oil is dissolved in the solvent, with the mixture being known as the miscella. The meal is also intimately mixed with, although of course not dissolved in, the solvent. Therefore, the next step in the process is the separation of the oil and meal from the solvent and the recovery of the solvent for reuse in the extractor. Although the oil and meal are subjected to further processing (refining of the oil and obtaining protein from the meal), for the most part such processing is not normally carried out at the extraction plant.

### RECOVERY OF SOLVENT FROM MISCELLA

A number of methods may be used to separate the oil and solvent fractions of the miscella. Regardless of the methods employed, the objectives of this separation are to remove the oil at the lowest practicable temperature and to recover the solvent with a minimum of loss.

The following accounts of the system used with the Central Soya Co.'s Bollman extractor is given only as an example of a method in use, and is not necessarily a typical picture of the

various separation procedures.

"The first part of the evaporation system consists of three atmospheric pressure evaporators in series, the first larger than the last two, containing inlets and outlets on approximately the same level so that the solution flows through These are heated by horizontal bundles of steam coils to maintain a vigorous evaporation of solvent. The miscella enters the first of these at the rate at which it comes from the extractor.

"The vapor from these evaporators passes through condensers and directly to the work tank. From this tank a small part of the lower layer, which contains some moisture, is pumped to the separation tank, whereas the major portion is pumped to the high tank supply the extractor.

From these evaporators the solution passes, by gravity, to a falling film evaporator. This unit consists of a vertical bundle of 212 tubes, each 8 ft. 103 in. long and I in. O.D., encased in a steel jacket. It is heated by steam at 15 to 20 psi. in the jacket. The oil solution runs down the inside of these tubes. By this process the concentration of oil in the solution is increased from 55-60 to about 90 percent. The vapors pass through a heat exchanger which is used

to heat the full miscella, thence to a condenser, and into the separation tank.

The next unit is a vacuum column, which is a steel cylinder 32 in. dia. and 44 ft. high, containing a 30-ft. section of 11-in. ceramic Berl saddle packing which extends nearly to the top. The oil is pumped into the top of this column, which operates at 21 to 22 in. of mercury vacuum, and flows down over the saddles and is collected in the unpacked space at the bottom. Live steam is introduced into the column

at the bottom and also just above the oil level, so that it bubbles up through the oil and passes upward through the column in contact with the downward current of oil to give steam distillation or scrubbing. The steam and solvent pass out the top of the column through a condenser and into the separation tank. The oil residue, now containing 99.5 to 99.7 percent oil, is pumped through a double-pipe, steam heat exchanger to bring its temperature to about 245 deg. F., and into the top of a second vacuum column which serves as a final stripper to ensure complete solvent and moisture removal. This is an unpacked steel column, 4 ft. in diam., and 30 ft. high. It operates at 26 to 28 in. of mercury vacuum. The oil is sprayed in at the top of the column while live steam is injected into the bottom. The vapors are pulled out the top and through a barometric condenser and steam jet ejector to the sewer. The residue, which is the final product and is now 99.85 to 99.95 percent oil, is pumped out the bottom of the column to the storage tank.

The average yield of oil per 540-lb. basket of beans is 96 to 100 lb., constituting 97 to 98

percent extraction.

SEPARATION OF SOLVENT FROM MEAL

After leaving the extractor, the meal must also Adhering be freed from adhering solvent. When com- solvent pared to the methods used to separate the miscella into its component parts, the mealsolvent separation procedures are comparatively simple as may be seen from the following description of a method which is in actual use. In order to provide a description of at least one complete solvent extraction process, the method employed in the plant of the Central Soya Co.,

Decatur, Ind., is presented.<sup>16</sup>
"The flakes entering the extractor contain 17 to 19 percent oil and 9.5 to 10 percent moisture. These are loaded about 540 lb. per basket. After completing the solvent cycle they are drained approximately 5 min. between the last spray position and the dump position in the extractor tower. At this point the basket load weighs about 690 lb. and contains about 35 percent solvent, 7 to 8 percent water, and 0.4

percent oil.

These wet flakes are carried into the meal desolventizing system made up of one unit on each of two sides of the extractor. Each unit consists of two, six-high tiers of Schnecken conveyors connected in series. The two tiers operate in parallel flow and empty into the same

deodorizing drum at the bottom.

The Schneckens are steam-jacketed paddle Foddle conveyors 16 ft. 8 in. long by 193 in. I. D. conveyors The meal passes from these units into the drum at a temperature of about 150 deg. F., and still contains about 10 percent solvent. The still contains about 10 percent solvent. deodorizing drum is a steam-jacketed 4-ft. diam. unit containing a steam coil mounted around the center shaft of a ribbon-type screw conveyor equipped with lifting blades to agitate the flakes. Live steam is blown into this drum to remove the last traces of solvent from the

flakes before they are discharged at about 200 to 220 deg. F. About 20 min. are required for flakes to pass through the system from the extractor to the drum discharge.

"The flakes from the drums on both of the units discharge into the same screw conveyor, where some moisture is removed by flash evaporation, and then into a Redler conveyor for movement to the meal manufacturing building.

"The average yield per 540-lb. basket is about 430 lb. of meal with a moisture content of about 8 percent and oil content of 0.6 to 0.7 percent. From this meal 97 to 98 percent of the oil has been extracted.

The vapors from the Schneckens and deodorizers pass through dust settling chambers and into condensers. The condensate flows into the separation tank, where the water is separated from the solvent."

REFINING OF OIL

Liquid-

axfraction

During the early days of solvent extraction, objections to the process were raised on the grounds that the oil produced was difficult to refine. This difficulty was apparently caused by the use of solvents which were lacking in selectivity. Since the use of more suitable solvents has practically eliminated the need for special techniques, the bleaching, refining, and deodorization procedures in use are, for all practical purposes, the same as are used for mechani-cally expressed oil. However, it should be noted that solvent extracted oils, particularly soybean oil, contain certain impurities, principally phosphatides (phospholipids), which must be removed within a short time after the extraction of the oil is completed. Therefore, this step which consists of precipitating the phosphatides by washing the oil with either water or steam, is usually carried out at the extraction plant prior to the shipment of the oil to a refinery, otherwise troublesome sludges will form, sometimes even while the oil is en route. However, the extraction plant usually receives compensation for the time and labor involved in precipitating these impurities, since the phosphatides are frequently purified and marketed (in the case of soybeans as soya lecithin).

Although not necessarily restricted to solventliquid extracted oils alone, a refining procedure emploving liquid-liquid extraction techniques which have much in common with the liquidsolid processes previously described has been developed in recent years. Actually, liquidliquid extraction per se is not particularly new; rather, it was proposed some time ago as a method of removing undesirable impurities from vegetable oils. In the proposed method, an organic solvent in which the undesired impurity would be soluble and the oil insoluble would have been used. However, this method has never enjoyed particular prominence.

The recently developed techniques referred to above are quite flexible, as they employ liquidliquid extraction not only for the removal of impurities, but also for the separation of various oils into fractions, each of which is of more value than the original oil. Thus, from soybean oil it is possible to produce two synthetic oils, one consisting of the glycerides normally found in edible oils and the other composed almost wholly of those rather highly unsaturated glycerides which are responsible for the drying qualities of the industrial oils.

There are two commercial processes which employ furfural and liquefied propane, respec-tively. The furfural process was developed by the Pittsburgh Plate Glass Co., which has operated a semi-commercial plant in Milwaukec, Wis., for the past several years. Following is a brief description of the furfural process.14

"As commercially operated, the furfural extrac- Furfural tion plant consists principally of a tall vertical plant column filled with packing. Inside the column a furfural-rich phase flows downward and an oilrich phase flows upward. Furfural, being the heavier liquid, is introduced at the top and the oil is fed at some point intermediate between the top and the bottom. A continuous stream of raffinate (residue) contained in the oil-rich phase, is withdrawn at the top. The extract, or furfural-rich phase, similarly leaves the apparatus at the bottom. After the oil dissolved therein has been separated from the solvent, a part of the extract is reintroduced at the bottom as reflux. Furfural is recovered from the products by evaporation and is recirculated to the apparatus.

By varying the relative amounts of selective solvent and oil, as well as the reflux ratio and other factors, it is possible to obtain any desired yields of extract and raffinate. A 50-50 split is not uncommon, but with equal ease the ratio of extract to raffinate may be made 10 to 90, 90 to 10, 30 to 70, or any other value.

The Solexol process, which employs liquid Solexol propane as a selective solvent, was developed by process the M. W. Kellogg Co. A pilot plant employing this process is now in operation in Jersey City, N. J., and seven commercial installations have been reported as being under construction or in operation. The equipment for the Solexol unit differs from that of the furfural process, one noticeable difference being attributed to the relative specific gravities of furfural, pro-pane, and vegetable oils. Inasmuch as propane is lighter than the vegetable oils commonly extracted, the extraction column operates in an upright position with the reflux returned at the top. 14 The furfural reflux leaves the apparatus at the bottom of the column, furfural being heavier than vegetable oils.

CONDITIONING OF MEAL

After being separated from the solvent, the Toasting meal is processed in accordance with its antici-pated future use. Thus, meal which is destined for incorporation is stock feed is toasted to increase its nutritive value, and, in the case of cottonseed and linseed meal, to detoxify certain components. It is mixed with steam until the proper moisture content is reached, cooled, ground if necessary, sifted, and bagged. However, the toasting operation is omitted from meal which is to be used for industrial purposes in order that the protein content of the meal can be obtained in an undenatured state. In contrast to the refining of oil, meal is largely conditioned at the extraction plant rather than at a separate installation.

### Continuous Solvent Extraction vs. Batch and Mechanical Methods

Continuous extraction methods offer a number of advantages over both mechanical processing procedures and batch solvent extraction When compared with mechanical methods, the primary advantage (and certainly the one that has been most responsible for the rapid development of the continuous extraction process) is the relatively low oil content of the residual meal An average value for solvent extracted meal is about 1 percent, while the oil content of meal from either of the two mechanical processes is rarely less than 5 percent.7 Since oil brings a much better price on the open market than does meal, this reflects a tremendous savings in processing oilseed having an oil content as low as that of the sovbean (about 19 percent). Other advantages are the reduced number of men required to operate the plant;2, 17 lower maintenance costs, which may be attributed to the lesser number of moving parts;10 and a lower power consumption (when compared with screw press operations only).2, 17 Another advantage, which has not as yet been fully exploited, is that undenatured protein, which may be used for a number of industrial purposes for which "cooked" protein is not suitable, may be obtained only from a solvent extraction process.

Better Probably the principal advantage of the con-tinuous system as opposed to the batch solvent system is that the continuous processes may be made to operate virtually on an automatic basis, thus insuring a more accurate control of the process conditions, and certainly presenting a lesser labor requirement. Other advantages are a lesser solvent requirement per pound of oil extracted and the higher degree of safety derived from the flow of material being processed through vapor-tight apparatus, without the necessity of periodic interruptions or manual intervention.10

However, continuous processes are by no means perfect. Despite the many technological improvements which have appeared in rapid succession during the past few years, a number of disadvantages remain:

1. Solvent extraction can be applied only with some difficulty to oleaginous materials having a relatively high oil content, because of the tendency of these materials to disintegrate to such an extent during extraction that the resulting fine particles seriously interfere with the operation of the solvent recovery system. How-ever, considerable progress is being made in solving this deficiency, as evidenced by the recent establishment of a plant (Sherwin-Williams) specifically designed for operation on materials having a high oil content; plus the operation of a number of plants for the processing of a material (cottonseed) which has a moderately high oil content.

2. The bulk of the personnel employed must Trained be well trained; a requirement which probably personnel could be met only with difficulty in many Southern oil mills because of the prevailing practice of using "floating" labor during the milling

3. The most efficient operation of a solvent extraction plant requires that it be operated 24 hr. per day on a year-round basis. course, is in distinct contrast to the current seasonal operation of the majority of oil mills in this region.

4. The minimum economical processing capacity (on a 24-hr. basis) is about 50 tons, although this figure is admittedly open to some discussion. Such a processing capacity would, of course, require either a steady inflow of oilseed throughout the year or sufficiently large storage facilities to accommodate virtually a year's supply of raw material. In view of the aforementioned seasonal nature of the operation of some mills, it is doubtful that many of their existing storage facilities would be adequate.

5. The initial cost of installing a solvent ex- Initial traction plant, while varying with the type of cost equipment, is in general higher than that re- higher quired for a mechanical expression plant of a comparable capacity.

6. Many extraction plants use highly flammable solvents, which represent fire hazards.

# **Economic Aspects of Solvent Extraction**

OPERATING COSTS

Comparative operating cost data are sparse and dated. However, it is known that operating costs of a solvent extraction plant are somewhat higher than those for a continuous screw operation of comparable size. But, increased oil yield will more than offset the increased costs.

Several recent actions of large-scale oil mill operators confirm this. In one instance, a proc-essor gradually replaced all of his continuous screw operations with solvent systems. In another case, when the price of soybean meal in relation to the price of beans became very unfavorable, a processor halted the operation of his continuous screw plant, while continuing to operate his solvent extraction plant.

As for solvent extraction vs. hydraulic press-

ing, a pilot plant study21 indicated considerable savings in labor costs by the conversion of Delta Product Co.'s hydraulic mill at Wilson, Ark., to a solvent process. One estimates of the savings on labor for this project is \$1.30 per ton.

The manufacturer has estimated the effect of increasing size from a 25-ton to a 200-ton Detrex extractor would be to reduce the processing costs for soybeans from about 20 c. to about 12 c. per bu. (Depreciation, insurance, taxes, overhead, etc. not included.)

### INSTALLATION COSTS

The processing equipment in a solvent extraction plant may represent less than one-quarter of the entire investment.

According to a consulting engineer special-

izing in the erection of oil mills, costs are largely dependent upon the type of oilseed, and a 150 to 200-ton solvent plant might require \$500,000 or more.<sup>18</sup> This figure includes preparation equipment, building, and auxiliaries

A Blaw-Knox representative estimates \$6-700,000 for a 200-ton solvent plant with preparation buildings, but exclusive of power gencrating equipment, railroad sidings, and storage

Switch

The Detrex Co. lists its 25-ton extractor at \$90,000, and its 200-ton at \$375,000, with construction and erection costs about \$10,000 and \$25,000 respectively. Presumably these costs are exclusive of buildings, land, railroad sidings, etc.

Naturally, the question arises whether mechanical expression plant equipment could be used in converting to solvent extraction. Some of the preparation machinery is interchangeable and can be used satisfactorily. An Allis-Chalmers representative estimates the cost of converting a 200-ton hydraulic plant to a solvent extraction plant of similar capacity to be about \$390,000 (\$190,000 for new equipment and \$150,000 installation costs).

Finally, 33 to 50 percent greater investment is estimated for a solvent extraction plant over a continuous screw plant of comparable size.16

### PRODUCT AND BYPRODUCT ECONOMICS

Although raw material prices usually move in the same direction as product prices, such movements may not be at a uniform rate. For example, during January 1950 prices of soybeans and soybean oil declined about 34 percent, while

soybean meal dropped 44 percent. However, regardless of the direction of such divergencies, solvent extraction appears to be economically attractive. If the cost of raw materials rises more rapidly than oil (or drops at a slower rate), solvent extraction plants, by virtue of the greater amount of oil obtained per ton of material processed, should be able to maintain profitable operation longer than mechanical extraction plants. This, of course, does not preclude the possibility that even solvent extraction operations may become unprofitable. On the other hand, if oil prices rise faster than costs of raw materials (or descend more slowly), a solvent extraction plant should produce a greater profit than a mechanical operation.

Meal from the solvent extraction process is potentially of more value than mechanically expressed meal, primarily because the latter meal may be used only for stock feeding and fertilizer purposes, while protein from the former is becoming increasingly important as a raw material for the production of adhesives, fibers, plastics,

and even food supplements.

### PLANT CAPACITY

To date, commercial operation of solvent extractors with a capacity around 10 tons has not been successful. Extractors of about 25-30 tons capacity have been moderately successfulone operator says his plant unit is more economical than screw presses. In any event, success of the small-sized unit appears to lie in the use of a non-flammable solvent and relatively untrained personnel.

Minimum economic size of plants using a flammable solvent appears to be 50-100 tons. The most popular size is 200-300 tons. Largest known plant as an 800-ton capacity.

### PLANT LOCATION

"Milling-in-transit" freight-rate privileges are freight extended to processors in cases where the raw privileges materials are unloaded at the plant, milled, and the resulting meal shipped farther along approximately the same route.28 Largest concentration of soybean processing facilities is at Decatur, Ill .- a situation largely resulting from the stragetic location of that city insofar as "millingin-transit" privileges are concerned.

Water requirements should not present any particular problem, provided no attempt is made

to locate a plant in an arid region.11

The labor requirement is usually one or two technically-trained operators per shift in a solvent extraction plant. "Floating labor" frequently employed in oil mills would not be

suitable here.

Successful operation of a solvent extraction plant is contingent upon continuous operation. Standard practice is usually to operate steadily for at least 300 days, and to close for repairs, etc., during the remainder of the year. A sufficient quantity of raw materials must be maintained to meet the requirements of continuous operation.

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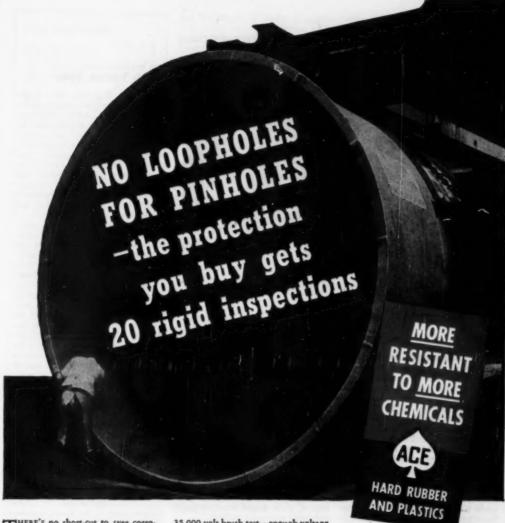
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THERE'S no short-cut to sure corrosion protection. Every ACE Rubber lined tank, valve, pump or piping system gets no less than 20 major inspections, developed through 100 years of experience with this finest of corrosion resistant materials.

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# Process Equipment News Educat by Cocil H. Chilton





The central dispatcher, at left, directs movements of electric lift trucks equipped with two-way, short-wave radio sets as shown in the righthand photo.

# **Two-Way Radio Boosts Lift** Truck Efficiency

Materials handling now on taxicab basis at Johnson & Johnson's new Metuchen shipping center.

Use of two-way radio (142A)as an aid to mechanized materials handling is one of the latest wrinkles in this fast-moving field. The new technique accomplishes two purposes: it keeps industrial trucks busy carrying payloads, instead of wasting time deadheading and it moves them promptly to busy spots where they are needed.

This idea is being put to work by Johnson & Johnson, whose new shipping center at Metuchen, N. J., already has been hailed as one of the finest examples of modern materials handling yet devised. It is in this same area that two-way radio is establishing a place for itself in the industrial pic-

J & J's operations involve receiving goods from its production plants, moving them to reserve areas or to the order picking floor, and thence to loading docks for shipment to customers. Internal handling, except for a dragline operating in the order picking area, is by a fleet of seven Skylift electric fork trucks, 2,000-lb. capacity, made by Automatic Transportation

Two-way Motorola short-wave radio sets are installed on each of the lift trucks. Placed to the right of the driver's seat, they are easily accessible. All sets, plus the master station from which all calls originate, operate on the same signal frequency. Thus, every driver hears all messages and can better orient himself to the entire opera-

Located in central dispatching headquarters, which is both the voice and brain of the materials handling system, are space layout charts and stock record location cards. The dispatcher knows the location of all merchandise, can keep up to the minute on the positions of his fleet, and can shift trucks and goods with great mobility.

Deadhead loads, idle time, waiting for a pallet load, and general confusion are reported to be eliminated. Another saving is in paperwork. In the past, assignments were worked out in advance, put on paper, and handed to each driver, who proceeded on his own from that point. With verbal orders, given one at a time, this paperwork is not needed.

For Johnson & Johnson, the cost of the radio equipment and its installation was \$3,200. The operation is too new for time study figures to tell how rapidly savings achieved by the radioelectric truck combination are paying out the investment. The company asserts, however, that dollar benefits are appreciable.

### BLOWS HOT AND COLD: Hilseh Vortex Tube

Requiring only a supply of compressed air at a few atmospheres of pressure, the newly redesigned Hilsch Vortex Tube manufactured by Thermo Instruments Co. will produce a cold air flow at sub-zero temperature, according to a recent report. This stream can be directed by suitable extension tubing into areas where cooling is desired. The most common uses to date involve the cooling of electron tubes, reference devices and optical elements.

Compressed air or other gas entering the tube through the perpendicular base of a tee connection passes into a tangential entry orifice. In the resulting vortex, the energy distribution is such that with proper adjustment of a throttling valve, the heated fraction exits from one arm. The cooled fraction emerges from the other arm, selected from the central mass of the vortex by means of a restricting dia-phragm. Maximum temperature difference is said to be attained with the flow regulated to produce a division of approximately 70 percent hot and 30 percent cold.

These production model tubes incorporate experience gained from experimental units previously available in limited quantities. Parts are chromeplated brass, assembled in tight permanent joints. Stainless steel or other metals can be supplied for corrosive or other special applications.

### Marshall and Stevens Indexes of Comparative Equipment Costs

(1926 = 100)

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected, and the selection of the method of obtaining the index numbers see R. W. Stevens, Chemical Engineering, Nov. 1947, pp. 124-4. For a listing of annual averages since 1913 see Chemical Engineering, Fob. 1950, p. 123.

Engineering, Fub. 190	10, p. 1	.55.	
	Sept.	June	Sept.
	1949	1950	1950
To Annaham	Torn	7900	2000
Industry		***	
Average of all	159.6	163.1	171.5
Process Industries			
Cement mfg	155.9	168.1	163.4
Chamieni	163.4	166.1	171.4
Clay products	150.4	153.1	158.4
Glass mfr.	153.5	156.2	161.5
			164.7
Paint mfr	156.7	159.4	
Paper mfr	157.0	159.7	165.0
Petroleum ind	159.8	162.5	167.8
Rubber ind	162.2	164.9	170.2
Process ind. avg	160.9	163.5	168.9
Belated Industries			
		167.7	173.0
Elec. power equip	165.0		
Mining, milling	164.1	166.8	172.1
Refrigerating	178.9	179.4	190.8
Ofeen nower	152.1	154.8	160.1

### New This Month . . .

amb baomin
Page & Item
Two-Way Radio142A
Hilsch Vortex Tube 142R
Torque Converter
Fire Extinguisher
Magnetic Clutch
Electrostatic Air Filter143D Reducing Valve143E
Reducing Valve 14310
Fork Trucks
Clear Flexible Tubing
Office Copying Machine 144C
Centrifuge Load Control 144D
Multiple-Unit Signal146A
Dual Disk Filter146B
Nodular Iron Castings 146C
Globe Valves
Globe Valves146D Improved Heat Exchanger146E
Check Valve146F
Kinetic Manameter 1484
Emulsification Unit148B
Centrifugal Separator148C
Master Control System 148D
Teffon Expansion Joint 150A
Control Valve
Spray Gun Pump150C
Remote Speed Control150D
Combustible Gas Alarm 150E
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Mass Spectrometer
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Motor Starters 156C
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Heating Glass
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Pump for HCl
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Impervious Graphite Pump159B
Protective Atmosphere 159C
Plastic Pipe Fittings159D
Fire Extinguisher
Foam Nozzle160A
Blow-Off Valve160B
Dust Collector
Mechanical Shaft Seal160D
Electric Stacker160E

### More Information . . .

To learn more about any item described here, circle the item num-ber on the Reader Service Postcard inside the back cover.

IN FRACTIONAL HP. SIZES:

### **Torque Converter**

A variable-speed torque converter, known as Zero-Max, is now available in five models from the manufacturer, Revco, Inc. These units provide a full speed range, infinitely variable from zero rpm. to one-quarter motor speed. Instant response to speed change and smooth flow of power are claimed. The reverse units provide instant reversal whether operating or not, and contain an instant neutral position for manual rotation of the output shaft in either direction.

In mechanical principle, the Zero-Max uses a group of cam-driven connecting rods on the input shaft to impart motion to connecting links which actuate over-riding clutches driving the output shaft. Secondary links shift the position of the connecting links in relation to the driving cams, changing the length of stroke through a range from zero to maximum. The speed of the output shaft is governed

accordingly.

Available models are designed to fit nearly all sub-fractional horsepower variable speed needs. Other models of greater torque for higher horsepower will be available in the near future, according to Revco.

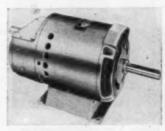
DRY CHEMICAL ENGINE:

### Fire Extinguisher

A new wheeled extinguisher for flammable liquid and electrical type industrial fires, the Alfco 350, has just been announced by American - LaFrance - Foamite Corp. Although the largest unit of this kind now available, it can be easily handled by two men, according to the announcement.

It carries the inspection and approval label of both Underwriters and Factory Mutual Laboratories.

The tank of the engine contains 350 lb. of Alfco Dry Chemical. The entire contents can be discharged, if neces-sary, in about 75 sec. Expellent is dry nitrogen, with a sustained operating pressure of 200 psi. during the entire period of discharge. Discharge range is 20 to 25 ft.



WORKS IN REVERSE. Magnetie Clutch

Vickers Electric Divi-(143C) sion's magnetic particle type clutch is now available in reversing and twospeed models. The new models incorporate two driving members with only one driven member. The two driving members rotate continuously in opposite directions; by energizing the proper excitation coil the driven member follows one or the other of the two driving members. By running the two driven members at different speeds instead of in opposite directions, the clutch becomes a two-speed transmission. Any combination of speeds may be used, whether they be close together or widely different.

According to the manufacturer, the new clutches retain the features of the original line, such as fast response, small control power, torque at zero slip, and large maximum to minimum torque ratio.



MADE OF SHREDDED PLASTIC: Electrostatic Air Filter

(143D) Development of an electrostatic air filter, making use of a plastic material, has been announced by the Goodyear Tire & Rubber Co. This filter utilizes the dielectric properties of polyethylene and other plastic materials. The material used in the filter is a thin film shredded into a porous mass. When exposed in a current of air, it is said to pick up an electro-static charge and thereby attract and retain dust, soot, or smoke particles carried in the air. The ability of capturing even the finest of suspended foreign matter in the air is claimed.

Filters now in use normally collect foreign particles by impingement on their adhesive coated structures, the dirt remaining on the air entrance side of the filter. The electrostatic filter collects foreign matter throughout its entire mass. Unlike conventional filters which, after washing, must be recoated with an adhesive material, it is reported that the Goodyear air filter can be cleaned and fully regenerated by immersion in water containing a detergent.

FOR HIGH-PRESSURE SERVICE: Reducing Valve

Atlas Valve Co. announces an improved Type E reducing valve for working pressures as high as 6,000 psi. For a number of years this company has been experimenting with the use of Stellite on valve parts subject to severe abrasion and corrosion. As a result, the Type E is now furnished with a Stellite-faced main valve and Stellited seat rings.

Design changes have also been made in the body of Type E for the purpose (Continued) NEW EQUIPMENT, cont. . .

of simplifying and strengthening it. The body is of high strength steel. Other internal metal parts are made of hard chromium-plated stainless steel. Packings are said to be specially made for high-pressure service.



Fork Trucks

Designed for conven-(144A)ience and maneuverability in the handling of 3,000 to 6,000-lb. loads is the Baker Industrial Truck Div.'s new line of Type FC center-control fork trucks. The operator stands on the right side of the vehicle and, because of the low panel, has an unobstructed view of the end of the forks when engaging the load. Ease and simplicity of operation are provided in one pedal which controls power and braking. This pedal is operated by the left foot in the normal driving position. An interlock cuts off power when brake is applied. A shockless, automotive-type steering wheel is equipped with a steering knob to facilitate sharp turning and backing into position.

Because of accessibility and functional engineering, the FC can be serviced quickly, according to the announcement. It is estimated that the power axle can be removed in 60 min., the trailing axle removed in 20 min., and brakes relined in 30 min.

Spark-enclosed construction is available at extra cost for safe operation in gas- and dust-laden surroundings.

### WATCH THE LIQUIDS GO BY: Clear Flexible Tubing

(144B) With the completion of new facilities, Munray Products, Inc., announces that it can now supply Cyclon crystal-clear flexible plastic tubing to the process industries. This tubing is said to be perfectly clear and entirely odorless, with no opacity or

yellowish cast. Available in a number of standard formulations, Cyclon tubing is adaptable to flow problems of the process industries where a clear and flexible conductor is needed. Conditions, however, must be within the temperature, pressure, and size limitations of the tubing. Being thermoplastic, Cyclon is not recommended for continuous exposure to corrosives at temperatures beyond 180 deg. F., although it can be used with complete safety at zero temperatures.

Extruded to a variety of diameters and wall thicknesses, Cyclon tubing can be utilized interchangeably for pressure and vacuum operation, usually without encumbering fittings. A full complement of sizes can be extruded, ranging from & in. I.D. to 1½ in. O.D. At ordinary ambient temperatures, pressure resistance is dependent on the diameter and wall thickness of the tubing. As a typical example, Cyclon tubing of & in. bore × & in. wall, has been used in dispensing carbonated beverages at 150 psi. without ballooning.



NO TRAYS NEEDED:
Office Copying Machine

(144C) Development of a new type of office copying machine is announced by the Charles Bruning Co. The new machine, named BW Copyflex, is reported to be the first machine specifically designed to make low-cost direct positive copies anywhere in a business office. It uses the standard BW diazo process, based on an aniline dye. BW Copyflex accomplishes the entire copying process within itself. It needs no inks, tray developing, darkrooms, subdued or special lighting. There are no fumes, and plumbing or exhaust fans are not required.

Copies can be made of any size of original matter up to 11½ in. wide by any length. If the original document is marked on both sides or is on opaque stock, the operator copies it onto reflex film and the film is then used to make

as many positive copies as are desired. Both sides of an original can be reproduced.

The machine can be placed anywhere in an office and is merely connected to a standard 60-cycle, 110-volt a.c. circuit. It is 29\frac{1}{2} in. wide, 28 in. deep, and 50 in. high.



STRAIN GAGE APPLICATION: Centrifuge Load Control

(144D) An interesting application of Baldwin SR-4 resistance wire strain gages has been made in the automatic control of Bird centrifugal filters. These are used for dewatering fine coal and slate in the Rovena coal separation plant of H. C. Frick Coke Co. Eight centrifugals handle 300 tons of coal per hr. in particle sizes up to 4 in. Two more separate water from 40 tons per hr. of slate in the same size range.

The torque required to operate each separator, driven by a 150-hp. motor, transmits a push against a Baldwin SR-4 load beam by means of a vertical arm extending down from one end of a horizontal shaft at the end of the machine. The arm is retained loosely by a clevis clamped on one end of the load beam as shown. The load beam itself is supported by a bracket extending out from the base of the machine.

The push of the arm strains the outer fibers of the beam which has SR-4 strain gages bonded on both sides. This stretches or compresses the wires of the gages and changes their electrical resistance. The change of resistance is transmitted to a Foxboro Dynalog recording controller, where it is translated and recorded as pounds of load, thus showing the conditions under which the separator is operating at all times.

If the filter load exceeds a set value as measured by resistance change in the SR-4 gage, the feed is cut off automatically until the machine has cleared

(Continued)



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NEW EQUIPMENT, cont. . .

itself. If the load continues to increase, however, beyond a maximum safe value, not only is the feed cut off but the machine is stopped. It is also stopped automatically if the torque load becomes zero, as when a shear pin breaks in the drive.



Multiple-Unit Signal

(146A) A new multiple-unit trouble signal for use in process industries and power plants has been announced by Panalarm Products Co. Combining signal lights and relay in a single steel container, the signal forms a complete one-piece unit that plugs into a universal chassis. In order to insure against loosening of the plug-in device, the manufacturer has developed a lock-in arrangement. A locking stud fastens to the chassis and extends through a hole in the signal unit; a thumb nut screws over the end of the stud, holding the unit tightly in place.

Panalarm back-lighted cabinets may be obtained with any number of alarm units, depending on the requirements of each individual user. Designation plates for each signal are printed or engraved, according to customer's specifications, to identify each process or piece of equipment and the particular condition existing when the alarm



Dual Disk Filter

(146B) In a new design of disk filter, Sparkler Mfg. Co. incorporates a V-shaped filter plate which permits

filtration through both sides of the plate. This is in contrast to the standard horizontal plate where only one side of the plate is used. The new design will probably provide higher flow rates in a more compact unit.



Nodular Iron Castings

(146C) Size limitations of nodular iron castings are being eliminated by development of improved techniques in this field. A pump case and cover having a combined weight of 8,314 lb. have been successfully cast by Farrell-Birmingham. The substitution of nodular iron for steel in a unit of this size is claimed to represent an appreciable saving in cost.

Crux of the casting process, requiring meticulous control, is the introduction of a small but effective amount of magnesium, which converts the graphite to spheroidal form. The resulting metal is much more ductile than ordinary cast iron and can be properly substituted for steel in many applications.



FOR PRECISION CONTROL: Globe Valves

(146D) Completing its line of Micro-Control valves, the Fairbanks Co. is introducing the Fig. 0525 150-lb. bronze globe valve. The stainless steel plug disk and seat, heat-treated to a hardness of 500 Brinell, are manufactured as a unit, precision ground for close control of flow and accurate seating. They may be re-ground; replacement disks and seats are also available

in matched sets. Resistance to corrosion, wire drawing, or damage due to solid particles in the fluid—inherent properties of hardened stainless steel are claimed to contribute to the long life expectancy of these valves.

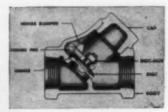
This series now covers 150, 200, and 300 lb. classes of valves.



NOVEL ASSEMBLY METHOD: Improved Heat Exchanger

An improved heat exchange unit which requires no welding or soldering in its assembly has been developed for chemical processing ap-plications. The Trane Co. uses a novel method for mechanically bonding # in. × 0.049 in. wall stainless tubing to flat plate type fins of stainless steel. The fins are stamped and belled, forming a bonding collar at each opening. This provides a broad flat surface instead of a flat edge at point of contact with the tube. Compressed gas propels a tool-steel bullet through the tube, expanding it uniformly against the continuous surface formed by the collars of the fins. It is claimed that this joint will successfully withstand repeated expansion and contraction caused by heating and cooling cycles.

To meet the exacting requirements involved in expanding tubes by means of tool-steel bullets, tubes fabricated to considerably closer than standard tolerances were required. These were supplied by Carpenter Steel Co.



Cheek Valve

(146F) A new line of Y-pattern brass swing-check valves has been (Continued)

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#### CRANE VALVES

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PROBLEM: To choose a pressure regulator that would assure a steady, unvarying steam supply to cooking kettle for an exacting brewing process.

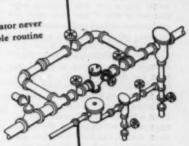
WORKING CONDITIONS: Regulator subject to continuous operation 24 hours per day. Main steam supply at 100 psi to be constantly reduced and maintained at 30 psi.

SOLUTION: Crane No. 960 Brass Pressure Regulator. (Former model with integral non-renewable cylinder.)

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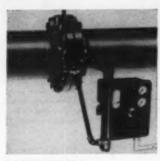
CHEMICAL ENGINEERING-January 1951

NEW EQUIPMENT, cont. . .

announced by Crane Co. Many improvements over the usual regrinding check valve are said to be included in the new design. A large cap opening on the same center line as the seat opening permits easy access for regrinding or replacement of parts. Easy contours in the Y-pattern body offer minimum resistance to flow. Closure on back flow is claimed to be fast and

Screwed end patterns are available in sizes 1 to 3 in., inclusive; flanged end patterns in sizes 1 to 3 in., inclusive. The new check valves can be used on lines where flow is either hori-

zontal or upward.



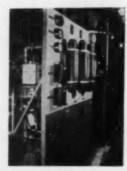
FOR FLOW INDICATION: Kinetic Manometer

Fischer & Porter has combined certain basic component elements into a new flow indicator and transmitter unit. This unit, used in conjunction with an orifice installed in the main pipeline, measures a portion of flow diverted around the orifice and passing through the instrument. Flow through the instrument is related to main line flow so that the indication of the instrument may be used to indicate the total flow.

Known as the V/A Cell, this instrument is said to combine certain advantages of the rotameter and the orifice meter and to eliminate numerous disadvantages of each. Unlike the rotameter, it provides a wide flow range in a single instrument. It retains, however, the rotameter's advantage of a linear scale. It eliminates the need for mercury, bellows, seals, exterior purges, condensate chambers, and manifold systems. By use of a magnetic coupling the position of the flow indicator can be converted into a pneumatic pressure for remote indication and control.

The V/A Cell is designed for application with liquid, gas, and vapor streams, including steam. The range of the instrument can be easily ad-

justed from 50 to 1,400 in. of waterair a positive whirling motion. As a differential. All parts in contact with the fluid are made of Type 316 stain-less steel. The instrument is connected to upstream and downstream taps similar to the usual static manometer. Pipe taps, flange taps, or vena contracta taps may be used.



FOR PAPER MAKERS: **Emulsification Unit** 

A commercial unit for the automatic and continuous emulsification of liquid rosin size has been designed by the American Cyanamid Co., working in close cooperation with the paper industry. Liquid rosin size is shipped as 70 or 80 percent solids, and before addition to the stock system must be diluted to about 4 percent solids. The new emulsifier system is designed to run smoothly day after day and to deliver uniform emulsion at all times to the paper mill sup-

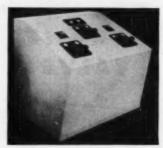


EMPLOYS HELICAL FLOW: Centrifugal Separator

A complete line of separators for use in removing unwanted liquids and solids from steam, air, or vapors under pressure or vacuum is announced by the Swartwout Co. Operating on the helico-centrifugal principle, Swartwout separators have a smooth helix that gives the steam or

result, unwanted liquids and solids are thrown against the wall of the separa-tor, where they run down to a drip pocket. The positive action of the separator assures that slugs of water will not be carried into the engine, turbine or other equipment, while oil and grease will not spoil work in process or gum up pipes. The manufac-turer claims that the separation process takes place with virtually no pressure drop.

Units are available in sizes ranging from 11 to 24 in. They are normally furnished in high tensile cast iron or cast carbon steel, but can also be made of steel plate to special order.



ELIMINATES PANEL PIPING: Master Control System

Republic Flow Meters Co. has announced the Telemaster, a new electronic system for use in centralized automatic control applications. The Telemaster transmits all impulses between the points of measurement or control and the central panel, instantly and accurately, without the lag caused by compressibility in long pneumatic

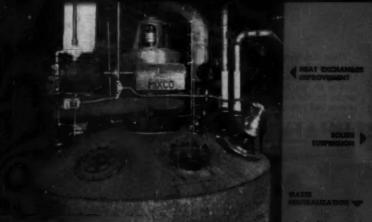
Control panel piping is elimi-nated. Instead, easily installed, multi-wire cables are the only connection between the small central panel and the

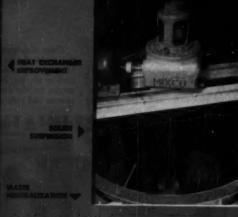
field elements.

Combining the null-balance principle of detection with electronic transmission of control information, the Telemaster forms a highly responsive control system that is claimed to be quite rapid in completing adjustments, regardless of the distances involved. There is a constant checkback between the initial input and final output, with no intervening mechanisms to cause dead spots or lags.

Manual operations at the central control panel are simplified, according to Republic. Changeover from automatic control to manual operation is accomplished instantaneously by merely throwing the transfer switchno synchronizing or balancing is neces-

(Continued)





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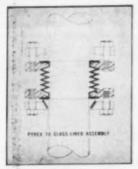
Lightnin Mixers.

New Equipment, cont. . .

sary. The reverse operation, switching from manual to automatic, is likewise simple. Both the position of the final control elements and the loading values are continuously reported and shown on paired position indicators at the control station. These indicators serve as a continuous check on the proper operation of the control system.

All parts subject to replacement are mounted on compact plug-in units that can be easily interchanged in a matter

of seconds.



ron rights mexicany: Teffon Expansion Joint

(150A) For use where thermal expansion, vibration, misalignment, or other conditions demand a flexible, chemical-proof piping section, United States Gasket Co. is now manufacturing Chemiseal Teflon expansion joints. They are said to be tough, heat resistant, and completely impervious to most chemical attack.

Fabricated by a special process, these solid Teflon expansion joints accommodate axial contraction and expansion or any reasonable amount of misalignment or vibration without danger of cracking or bursting, according to the manufacturer. They are designed for 25 psi. pressure and are serviceable throughout the temperature range —150 deg. F. to 400 deg. F. They, are normally supplied with suitable integrally gasketed flanges drilled to 150 psi. ASME standards.

#### Control Valve

(150B) R-S Products Corp. is now manufacturing an off-center valve of the disk type which is claimed to simplify the control of 15-psi. saturated steam with a low pressure drop. This valve, designated No. 780, is provided with a double crank arm with adjustable weights which facilitate accurate setting.

These disk-type valves are available in a range of sizes and can be specified for higher pressures. They are also used in air, gas, liquid, and semi-solid service for the control and shutoff of volume and pressure.



Spray Gun Pump

(150C) Spray gun spurting, which often projects a blob of heavy material upon the surface being coated, is claimed to be eliminated by a new Powerflo pump manufactured by the Gray Co. Equipped with a device called Evenflo, designed to prevent spurting, the new pump facilitates the application of even coats. These pumps operate in 400 and 100-lb. drums, or in bucket-type containers. They can be powered by air pressure over a range of 20 to 175 psi.

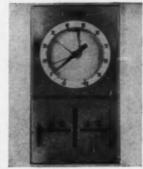
The power head is cast aluminum. The air motor incorporates steel forgings and machined castings for durability, and large poppet valves for efficiency. Easily changed O-rings stop blow-by to provide leakproof seals in the air motor. The piston has balanced double action for smooth, high-

volume delivery.

#### WITH COMPANION INDICATOR: Remote Speed Control

(150D) A new electric remote control for variable speed drives has been announced by Sterling Electric Motors, Inc. It is designed for use with Sterling's Speed-Trol electric power drives, and is available in a package unit, which includes a mounting bracket, reversing motor, chain and sprockets, friction clutch, chain guard, and remote "Fast-Slow" station. Speed-Trol drives, available in ratings of 4 hp. to 25 hp. inclusive, are manufactured with 2:1, 3:1, or 4:1 speed variation in a range of speeds from 2,000 rpm. down to 26 rpm.

An electric remote speed indicator companion unit is also available. Both units may be mounted on any Speed-Trol by any mechanic.



NEW OPERATING PRINCIPLE: Combustible Gas Alarm

(150E) A continuous combustible gas alarm system incorporating what is claimed to be a new, more accurate principle of gas and vapor analysis is announced by the instrument division of Davis Emergency Equipment Co. Improved precision is achieved by use of a thermocouple in conjunction with a filament employing fine platinum wire. The thermocouple measures and records the actual increase in temperature of the wire rather than the increase electrical resistance as is done in the older wheatstone bridge principle.

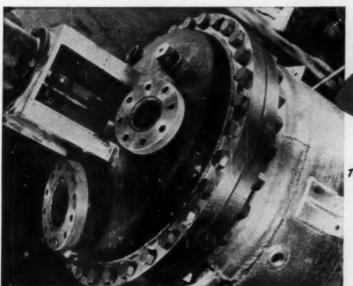
Zero drift, a major factor in the wheatstone bridge, is said to be virtually eliminated. Consequently, the new instrument can be used as a continuous detection and alarm system for the protection of processes, plants, and personnel. It has already been placed in operation by Shell Oil Co. to protect pipeline automatic pumping stations. The system is set to shut down the station before the vapor-air concentration reaches an explosive mixture.

In the new Davis alarm system all relays are energized. Thus the failure of any relay—audible signal, appliance control, filament, or thermocouple burnout—gives immediate visual warning on the panelboard. In addition the drawing of the sample is monitored and immediate warning is given of clogged filters or flashback arrestors.

FOR ACIDPROOF PLOORS:
Glass Fiber Membrane

(150F) As an addition to its line of corrosion-resistant construction materials, Pennsylvania Salt Mfg. Co. has introduced an inorganic glass-base fiber, known as Glasfab. This material is said to be gaining popularity among engineers and contractors for construction of acidproof floors. It is used as a reinforcing membrane between bitu-(Continued)

Enduro STAINLESS STEEL





THRIFTY METAL OF 10,000 USES

High temperatures and heavy pressures are easily kept under cautral in this stanies used autocaw. Earst-slavicate ENDURO is vary mistable for such equipment subver extensive machining and welding are involved. It is used widely throughout the chemical process industries in tanks, agitators, condensors, conveyors, digasters, dryer, evaporators, filters, retorst, stills, piping and tubing and shipping containers.

#### TRIPLE SECURITY ON THE PROCESS LINE

Would greater pressures speed your processing?

Could scorching heat or sub-zero cold squeeze more product from your operations?

Is freedom from contamination important to both product and equipment?

Then you can profitably use the triple protection of Republic ENDURO Stainless and Heat-Resisting Steels.

Strong, tough ENDURO equipment safely allows you to pile on the pressure. It maintains its great strength at both scorching and frigid temperatures. It does not contaminate metallically. Easy to clean and to keep clean, it discourages the accumulation of contaminating impurities.

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Quick way to processing profits—redesign around these ENDURO qualities. Your equipment supplier, or any Republic District Sales Office, can give you more detailed information.

CHECK ALL 12 ADVANTAGES: Rust- and Corrosion-Resistance • Heat-Resistance 
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Stability • No Metallic Contamination • Easy to Clean • Easy to Fabricate • Byo Appeal • 
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CHEMICAL ENGINEERING-January 1951

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NEW EQUIPMENT, cont. . .

minous materials in place of tar paper or felt.

According to the manufacturer, Glasfab is impervious to dampness, unaffected by heat, water, rot, fungus, or decay, and is strong and durable. In addition, there is no opportunity for the capillary or "wicking" action characteristic of organic fibers.



Wound-Rotor Motors

(152A) Electric Machinery Mfg. Co. announces a new line of heavy-duty, wound-rotor induction motors. Providing variable speed drive, these motors are also claimed to be advantageous on applications requiring high starting torque and low starting current, or long acceleration periods. Drip-proof construction is furnished as standard, although splash-proof or enclosed, forced-ventilation models are also available. They can be obtained with either ball or split-sleeve bearings.

Brush pressure is easily adjusted by means of a ratchet wheel tension adjuster which provides metered step-by-step increase or decrease of pressure on the individual brushes. The new line is available in ratings from 30 to 1,500 hp.

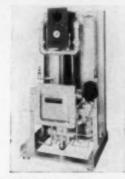


USES A "PIN-JET": Fog Nozzle

(152B) Extremely fine and uniform fog droplets at low operating pressures are claimed for a new line of low gallonage nozzles by the manufacturer, Bete Fog Nozzle, Inc. Employ-

ing the "pin-jet" impingement principle, the new nozzles have no internal parts and cannot clog with foreign particles smaller than the orifice size, according to the manufacturer. A new pin design reduces interference of the pin with the fog pattern, a defect common to previous nozzles of this type. Made in 10 orifice sizes from 0.015

Made in 10 orifice sizes from 0.015 to 0.080 in. in diameter, the new Bete nozzles are rated from 1 to 100 gph. They are available from stock in brass with stainless steel pins, and made to order in various other metals.



POR BALARDOUS LOCATIONS: Dehumidifier Unit

(152C) An explosion-proof dehumidifier unit for use in hazardous locations is now available from the Industrol Corp. The unit consists of two steel drying chambers filled with Socony-Vacuum Sovabead desiccant. Each chamber is on the line drying air for 6 hr. while the other chamber is being reactivated. Operation is said to be fully automatic. The reactivating elements operate on 110-volt, 60-cycle current.

Rated capacity at 100 psi. and 70 deg. F. is 50 scfm. Outlet dew point is claimed to be -40 deg. F.

FOR SMOOTHER FLOW

#### Pulse-Free Piping System

(152D) A new pulsation dampening piping system is now being offered by the Fluor Corp. It is a complete compressor piping system designed to diminish objectionable peak pressures caused by the reciprocating action of compressors. Its object is to obtain smooth, steady flow of compressed gases. Design and engineering of the patented system is predicated upon the proper juxtaposition of bottles, laterals, and headers to provide the appropriate components of acoustical filters, the basic principle of the Fluor pulsation dampener.

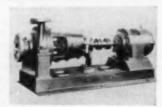
In new construction, the initial ad-

vantage of the system is to enable the operator to design and specify related equipment based on a piping system free of pulsative gas flow and its attendant problems. Other considerations claimed are increased safety possible through elimination of vibrational stress on piping and equipment; increased compressor operating efficiency by virtue of handling uniform gas loads; and a reduction in metering inaccuracies.



SOLVES DESIGN PROBLEMS: Strain Gage Application

Design of this fabricated steam chest was based to a large extent on resistance wire strain gage measurement on the walls, cover, and bolts. Baldwin SR-4 gages were bonded to interior and exterior walls at 14 points and to the center of the cover. Four additional gages were bonded 90 deg. apart on each of two studs in the centerline of the long sides and cover so as to give axial strains and stresses. Strains were measured when the pressure in the chest had been raised to 1,200 psi., double normal operating pressure. Results of the tests were the basis for a decision to build steam chests with curved walls whenever practical and to fasten the cover to the flanges by studs located inside the centerline of the walls where they join the flange.



Process Pump

(152F) An improved line of pumps for process use has just been announced by Economy Pumps, Inc. Known as Type Q pumps, the new line is especially designed for use with Dowtherm, hot oil, condensate, pro(Continued)



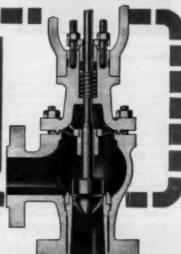
Drainer Control Valve

FOR OPERATION BY PRESSURE OR LIQUID LEVEL CONTROLLERS

#### Features:

- Angle body construction with renewable chrome nickel steinless steel seet ring. Directs flow directly line outlet plains, Protects body from contact with high velocity flashing fluids—preventing body weshout difficulties.
- Easily dismonthed for replacing worm internal parts
- Available with heavy duty or conventional positive alignment inner valve guiding.
   Iron or steel flanged angle body construction in sizes 1", 2", 3", 4" and 6".
- Operated by suitable super-structure to overcome pressure unbalance conditions.
   Furnished with Fisher Teffon V-Ring Facking, Requires no lubrication.





Fisher Governor Company

pane, butane, gasoline, chemical and process liquors at temperatures up to 800 deg. F. Although materials used for construction vary for each particular application, these pumps have certain common design features, such as: vertically split casing with centerline support to maintain alignment at all temperatures; an extra deep, waterjacketed stuffing box; a special sleeve construction for prevention of leak-age; and water-jacketed bearing housing for ring-lubricated ball bearings. Type Q. pumps are said to be easily dismantled and reassembled, without disturbing piping or alignment. They are designed for minimum NPSH re-quirements and are available with open, semi-open, or enclosed impellers.

Twelve sizes are included in the new line, with capacities ranging from 10 to 1,000 gpm., and heads up to 325 ft. Standard models include: bronze fitted, all-iron, all-bronze, steel, and stainless steel. Special materials can

be furnished on order.



EXTENDED BANCE:
Mass Spectrometer

(154A) A new mass spectrometer offering increased sensitivity and a mass range up to 400 has been developed by Consolidated Engineering Corp. Model 21-103 is the culmination of years of research. All performance characteristics of former Consolidated instruments have been retained, but their range and scope have been expanded.

An entirely new ion source, the Isatron, is responsible for the increased sensitivity. Besides increasing the resolving power to extend the mass range to 400, provisions have been made to permit adjustment during operation. This means that for normal operation in the lower mass ranges, the instrument can be set to provide optimum scanning speed, sensitivity, and peak shape, yet can be readjusted quickly by means of a dial setting for high mass work.

Featured in the new model is an entirely new sample introduction sys-

tem. Its main body is machined from stainless steel and incorporates metal valves as an integral part. A number of the electronic control circuits in the new instrument are modernized for greater reliability and ease of maintenance.



PERMITS VERTICAL LIFT: Centrifugal Clutch Coupling

(154B) A new type Rawson centrifugal clutch coupling for use with heavy equipment is announced by its designer and manufacturer, Centric Clutch Co. This new unit was constructed to permit vertical lift from the mounting of either driver or driven equipment without disturbing either member, wherever moving heavy equipment is a problem.

Most dual drives to pumps, fans, and generators are good applications because the equipment is generally mounted in concrete and is unusually heavy. Space restrictions often make telescoping of couplings for assembling and disassembling extremely difficult or impossible. The vertical lift coupling finds application in such instances, and is said to simplify maintenance of equipment and reduce shutdown time to a minimum. The normal Rawson type clutch action is not affected in any way by the vertical lift feature.

These new couplings come in nine sizes ranging from 6 in. × 2 in. to 24 in. × 8 in.

#### Electronic Hygrometer

(154C) A new electronic hygrometer for measuring and controlling industrial and commercial air conditioning has been announced by Minneapolis-Honeywell. Operation is based on the fact that a hygroscopic salt conducts more electricity when in equilibrium with moist air than when dry. A new sensitive element, which does away with the use of human hair, consists of a clear plastic base on which is mounted conducting electrodes shaped like the teeth of a comb. The electrodes are made of pure gold leaf

and are pressed onto the surface of the plastic base. The entire element is coated with a solution of a salt.

In operation, the sensing element determines the amount of moisture in the air by measuring a minute change in electricity carried by the salt between the teeth of the electrodes. The salt film carries a higher current when in moist air. The electric change in the element is suitably amplified through electronic tubes to actuate remote indicating, recording, and controlling instruments as desired.

These instruments can be used for sensing changes between the limits of 20 and 93 percent relative humidity. They are calibrated to plus or minus 1 percent accuracy, allowing relative humidity to be held within closer tolerances than previously possible, according to the announcement. The sensing element is generally unaffected in corrosive atmospheres normally encountered in industrial working areas.



FOR STRETCH RESISTANCE: Flat Leather Belting

(154D) A new type of flat leather belting incorporating a rayon tire cord insert to provide stretch resistance is being produced by the Charles A. Schieren Co. This belting consists of a layer of rayon tire cords cemented between two layers of leather. The use of rayon tire cord to improve stretch resistance was found to be effective in an earlier Schieren product, a leather V-belt. An extremely low stretch characteristic in service is claimed for the belt. Some users of rayon-insert flat leather belts have reported six months to a year of operation without any take-up.

This belt can be scarfed and made endless with the same ease and by the same method as any other flat leather belt. Regular belt fasteners or lacings can also be used in the customary man-

ner.

The manufacturer reports that the new belt is particularly suited to motor drives equipped with automatic tension or pivoted bases. Eliminating the (Continued)

#### AUTOMATIC CONTROL

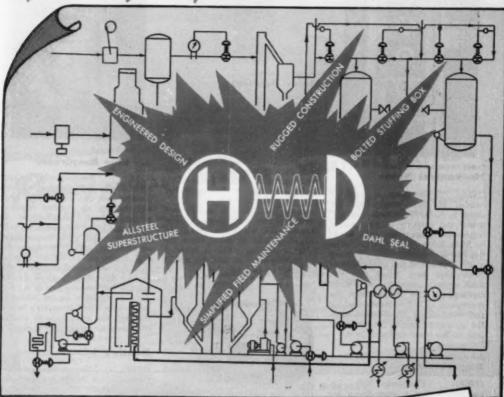
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EQUIPMENT

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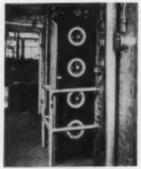
ALBANY BOSTON BUFFALO CHICAGO CINCINNATI

SEATTLE ST. LOUIS SYRACUSE L'TOLEDO TULSA WILMINGTON DE

n Canada Railway & Power Engineering Corneration 11

NEW EQUIPMENT, cont. . .

normal stretch in a belt on these drives reduces the possibility of the base tilting down until it touches, thereby relieving the tension in the belt. Such a condition often prevents the base from functioning properly and causes the belt to slip and burn.



Mechanical Noses

(156A) Goodyear is using a number of these combustible gas alarms at Akron for protection of personnel and property in areas where combustible gases might exist. Made by Mine Safety Appliances Co., their function is to detect and give warning of the presence in the atmosphere of combustible gases before they can reach explosive concentrations. Pumps continuously draw samples from the atmosphere at various points. Audible and visual alarms are activated when the vapor concentration exceeds 30 per cent of the lower explosive limit.

#### SAVES PACKING SPACE: Bag Flattener

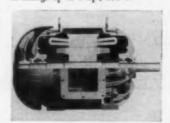
Flexoveyor Mfg. Co. has brought out a power-driven bag flattener and pallet loader which may find application in any industry that packs and ships its products in bags. A series of endless steel coil springs running over grooved steel rollers forms the conveying medium. By means of a tension spring and a rocker arm connection between upper and lower conveyors, a mechanical action is applied to the bag which is claimed to eliminate air and distribute the contents evenly. The resulting flat bag is said to save as much as 30 percent in space because of more compact packing. The discharge conveyor section may be raised or lowered by means of a hydraulic ram so that bags can be piled on pallets and follow the height of the tier.



Motor Starters

(156C) Two new motor starters have been introduced by Westinghouse Electric Corp. For across-the-line starting of squirrel-cage induction motors, there is the new Class 11-206-N starter which combines starting, protection and disconnect features in a redesigned enclosure that saves space and increases safety. This starter is suitable for sizes up to 100 hp., and voltages to 600.

In addition, there is an improved manual starter, the Motor Sentinel Class 10-023, which incorporates an indicating light to show when the motor is running. This is intended for starting small ac. and dc. motors in ratings up to 1 hp., 250 v.



Explosion-Proof Motors

(156D) Elliott Co.'s Crocker-Wheeler Div. has announced a line of explosion-proof motors, approved by Underwriters Laboratories for Class I, Group D and Class II, Groups F and G hazardous locations. The motor is an adaptation of the Crocker-Wheeler Sealedpower design. Cooling air is directed by an external fan over fins which are cast into the corrosion-resistant gray cast-iron frame. There are no internal passages to clog and cause overheating, according to the manufacturer. The double-row bearings, prelubricated and sealed, are stated to require no attention for at least five

years. Motor leads are sealed in the frame, permitting rotation of the conduit box to any of four positions, 90 dee anart.

deg. apart.
The Sealedpower explosion-proof design is available in NEMA frames 364 through 505.



FOR SAFER BREATHING:

#### Air Line Respirator

(156E) Recommended for such operations as paint spraying, welding, cleaning tank cars, and abrasive blasting, the new air supplied respirator pictured above, manufactured by American Optical Co., is claimed to be especially useful where contaminants are unusually heavy. It protects against dust, furnes, and smoke. No filters or cartridges are needed because a continuous flow of fresh air is directed through the hose. Air flow to the face-piece is regulated by an adjustable valve clipped to the worker's belt or clothing. The valve locks in position and cannot be accidentally changed.

#### **Heating Glass**

(156F) Newest development of Corning Glass Works is a conductive coating which can be applied to glass, enabling the passage of electric current to produce heat. The new radiant glass panels thus formed are suitable for temperatures up to 350 deg. C., and for heat dissipation at rates up to 10 watts per square inch in free air, or higher with forced cooling. As much as 80 percent of the available heat is said to be radiated effectively.

#### Graphic Panel Recorder

(156G) Taylor Instrument Cos. are now offering a line of extremely compact pneumatic-receiver recorders for use on both graphic and conventional control panels. These instru(Continued)



MINERAL . VEGETABLE MATTER

CHEMICALS, SOAP CHIPS, ETC. Many dry chemicals are being ground with Williams Heavy Duty Hammermills. Capacity is unusually high and power involved and maintenance extremely low.

OIL CAKE (INCLUDING SOYA),

COPRA AND COTTONSEED Such material, easily ground for use as animal food, whether it is expeller cake or hydraulic press cake.

ANIMAL AND FISH BY-PRODUCTS Hundreds of installations are daily proving our claims for better and more satisfactory reduction of such materials as -- cracklings, tankage, fish acrap, raw and dry bones, etc.

Many canneries, breweries, and municipalities re-GARBAGE, SEWAGE duce waste materials for disposal with Williams Heavy Duty Hammermills prior to flushing through the sewers with water.

STEEL, ALUMINUM AND OTHER METAL TURNINGS Such materials are readily reduced to "hand shove!" size for easier handling. A metal trap catches stude, bolts and other uncrushables.

ROOTS, HERBS, BARK AND CHIPS

Such vegetable substances are successfully shredded prior to commitment to extracting processes. This treatment permits maximum extraction from the material.



STANDARD DESIGNS FOR BIG OR LITTLE JOBS

Standard machines are available for the reduction of practically every material. Capacities range from 50 to 600,000 lbs. per hour.

WILLIAMS ALSO MAKES . . .

ct and roller mills for 200 to 325 mosh grinding; drier mills; air ring screens; steel bins; complete "pockaged" crushing and grine

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OLDEST AND LARGEST MANUFACTURER OF HAMMERMILLS IN



NEW EQUIPMENT, cont. . .

ments have a 30-day strip chart and measure only 4½ x 5 in. on the face. Therefore, many of them can be mounted in the same space required by only a few conventional recorders.

#### Pump for HCl

(158A) The Flex-i-liner pump made by Vanton Pump Corp. and previously described in these pages is now being provided with a specially formulated rubber liner for handling hydrochloric acid. It will be recalled that the pump operates without stuffing boxes by the squeeze action of a rotor moved by an eccentric against a flexible liner in a cylindrical cavity.

#### Plastic Tubing

(158B) Tygon flexible tubing manufactured by U. S. Stoneware Co. is now being made in sizes from 1½ to 2½ in. O. D., in addition to the smaller sizes formerly available. The tubing is translucent and resistant to most acids and alkalis.

#### Bottle Filler

(158C) A new bottle filler, designed to reduce absorption of air in liquids, is being manufactured and marketed by Valley Foundry & Machine Works. This filler injects its spout to within \$\frac{1}{4}\$ in. of the bottom of the bottle, in contrast with the sprayfill type which is injected only 2 or 3 in. into the bottle, with resultant exposure to oxygen. It is currently offered in manual and automatic models.

#### Safety Relief Valve

(158D) The development of a new moderately-priced, large-capacity safety relief valve for small water heaters and tanks is announced by McDonnell & Miller, Inc. These valves are rated by Btu. capacity. At normal temperature, water is relieved at a low rate, but when temperature rises into the emergency zone the increased velocity acts on a lift ring, snapping the valve wide open to dissipate heat at full discharge rating.

#### Gas Compressor

(158E) A new unit for compressing natural gas or for use in any industry requiring gas under high pressure is announced by the White-Roth Machine Corp. Designated by the manufacturer as the Lorain Model A-9 compressor, the new unit is powered by a Lorain Model A multi-fuel en-

gine. It is now in quantity production and available for domestic or export markets.

#### **Evaporative Condenser**

(159A) Niagara Blower Co. is now making a new high-capacity Aeropass condenser to serve large refrigeration plants. Its nominal rating is 300 tons, and in field tests approximately 350 tons capacity is reported. In principle it is like the smaller units made by this company, utilizing the company's patented pre-cooling coil and oil separator.

#### Impervious Graphite Pump

(159B) National Carbon has announced price reductions in Karbate impervious graphite pumps. The new lower price, which does not include the motor, will permit wider application of Karbate in corrosive services. These pumps are constructed with Karbate case and impeller and a Teflon gasketed mechanical seal.

#### **Protective Atmosphere**

(159C) A new package-unit Monogas generator has been added to the line of protective atmosphere equipment manufactured by Westing-house. Monogas is a non-decarburizing, neutral atmosphere; it consists essentially of nitrogen, with carbon dioxide, oxygen, and water vapor removed. High operating efficiency is claimed to be obtained with the new generator by utilizing the waste heat of combustion to regenerate the CO<sub>4</sub> scrubbing liquid. Units are available in sizes ranging from 500 cfh. to 5,000 cfh.

#### Plastic Pipe Fittings

(159D) Carlon Products Corp. is now producing a new line of ells, tees, and couplings designed for use with their rigid plastic pipe. These new fittings employ external shoulders (similar to metallic fittings) which are claimed to greatly increase their overall strength.

#### Fire Extinguisher

(159E) American - LaFrance Foamite Corp. has just announced a pressurized 1-qt. fire extinguisher which can be operated with one hand. It can be recharged by simply pouring in more vaporizing liquid and can be pressurized with any standard air chuck as commonly used in service stations. It can be used for extin(Continued)



Maybe it all does look pretty much the same at first glance. But when a firm has been mak-

# WIRE MESH

ing wire mesh for 70 years man and boy, there's bound to be a little more to it than meets the eye—a little more know-how in engineering and weaving, a little more quality in the product, a little more service and satisfaction to the user.

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EQUIPMENT IS NEEDED



**Descriptive Bulletins on Request** 

LEE METAL PRODUCTS CO. INC.

ALL LEE KETTLES ARE MADE TO A.S.M.E. CODE

NEW EQUIPMENT, cont. . .

guishing both flammable liquid and electrical type fires, according to the announcement.

#### Foam Nozzle

(160A) A foam nozzle that can be changed from a closely-knit spray to a long-range stream is now available from National Foam System, Inc. By means of a suitable bolt action, the operator can control the nozzle to provide the desired type of discharge for combatting a particular type of fire.

#### Blow-Off Valve

(160B) Everlasting Valve Co. announces the addition of a straight-way Y-type valve to its line of boiler blow-off valves. The disk is made of "H" Monel and the seat of Monel metal. This combination of metals is said to be well suited to withstand the erosive and corrosive conditions to which a slow-opening blow-off valve is subjected. These valves are offered in 1½ in., 2 in., and 2½ in. sizes, in cast iron or cast steel, for pressures up to 600 psi.

#### **Dust Collector**

(160C) Model 8N50 is the newest addition to the line of Dustkop dust collectors announced by Aget-Detroit Co. Rated at 885 cfm. with 3 in. static suction, this model is recommended where outside exhaust of cleaned air is required due to state regulations or to the presence of toxic fumes or vapors. It is a standard unit available from stock.

#### Mechanical Shaft Scal

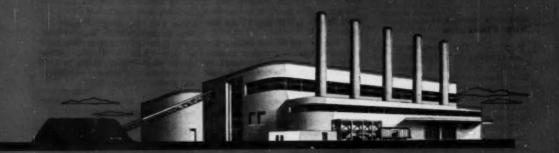
(160D) To meet the shaft sealing needs of pump manufacturers, the Sealol Corp. now offers a new line of mechanical seals. These are all-in-one seals—complete in one package, factory-assembled and tested. No special machining on the part of the pump manufacturer is required when these seals are used.

#### Electric Stacker

(160E) Addition of 11 in. of lift to its tilting telescopic Transtacker has been announced by the Automatic Transportation Co. The unit is one of six driver-led electric stackers of the suspended fork type, just added to Automatic's line. The increased lift means that the tilting and telescopic model now tiers to 131 in.

-End

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### New Products and Materials Educa by Richard V. Roeves

#### New Fluorides

(162A) The Pennsylvania Salt Manufacturing Co. has announced the first three of a series of organic sulfonyl fluorides. Available in experimental quantities for evaluation purposes are benzenesulfonyl fluoride, p-chlorobenzenesulfonyl fluoride and m-nitrobenzenesulfonyl fluoride.

Chemical properties and stability of these sulfonyl fluorides differ sharply from those of the analogous sulfonyl chlorides. The fluorides are thermally stable and are resistant to hydrolysis, chlorination, oxidation and elevated temperatures. They show an unusually wide range of solvent properties. The vendor recommends them for evaluation as solvents, as heat transfer agents, as intermediates in the manufacture of dyestuffs, and as chlorination media.

The company indicated it is conducting research in the production and application of other compounds in this class hitherto not available for commercial exploitation. It intends to make additional ones available as fluorine research progresses.

#### SURFACE BARDNESS:

(162B) A new enamel—a silicone based hybrid between poreclain and plastics—is the newest product to come out of the Glidden Co.'s paint and varnish division laboratory. It is the first of its kind to pass the laboratory development stage.

The enamel is able to boast the surface hardness and chemical resistance of porcelain without its brittleness.

of porcelain without its brittleness.

The success of this goal is attested by a severe laboratory ordeal to which the new silicone product was subjected. It was treated with a wide range of chemicals, including strong corrosive acids, without apparent change. It resisted the staining of dyes, including substance that gives mustard its color, which is one of the most annoying stains with which manufacturers of household anniances have to deal.

household appliances have to deal. It has withstood a fog of 20 percent salt water solution for 4,000 hr. at 95 deg. F. without any effect except some slight corrosion at the edges of the metal test strip where the finish had been previously broken. The corrosion, however, did not travel any further, or creep under the surface of the enamel, as is characteristic of corrosion under finishes. Soap solutions at tempera-

tures as high as 180 deg. F. did not affect it.

While the new silicone finish is not as heat resistant as porcelain enamels on pots and pans it is not as brittle. It will also withstand much higher temperatures than any finishes made of the customary organic resins.

Because of materials shortages and other factors, the company announces that the enamel will not be available commercially for perhaps a year.

#### Electroplating Agent

(162C) An addition agent for electroplating baths has been announced by Westinghouse Electric Corp. When added in small doses to cyanide copper-plating baths, the plated copper is smoother, less grainy and can be laid down at a faster rate.

The company points out that the development of the addition agent, called Wes-X, is particularly timely since the trend is to thicker layers of copper to provide better corrosion protection. When the conventional cyanide electrolytes were used, thicker copper plate became too rough, too grainy. Use of cyanide copper electrolyte seemed to be decreasing, being replaced by the acid-type electrolyte. By using Wes-X addition agent, however, heavy, smooth and bright deposits of copper are now produced in the cyanide solution.

The product utilizes an inorganic metallic salt as a base instead of an organic one. The baths are said to be stable with this inorganic agent because no decomposition products build up to cause low quality deposits such as those which occur with organic agents. Product is applicable to both conventional and periodic reverse-current plating techniques.

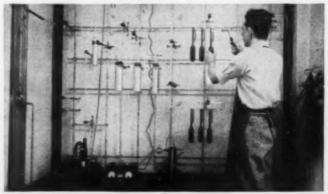
#### ANTIBIOTIC: Feed Supplement

(162E) First antibiotic animal feed supplement was announced today by Chas. Pfizer & Co. The supplement contains terramycin and is called Bi-Con TM-5. It has been prepared especially for poultry and swine.

Extensive tests carried on by scientists at various state colleges, particularly at the Washington State College and Iowa State College, have shown that certain antibiotic residues have the effect of promoting growth of chickens, turkeys, and swine.

Broad spectrum or wide-range antibiotics, such as terramycin, were shown to be relatively more effective in animal nutrition than narrower range antibiotics such as penicillin and streptomycin. The experiments with terramycin were conducted to discover the minimum amount of antibiotic required in feed to give the optimum response—a factor important in producing more economic animal feeds.

The feed manufacturer needs to use only two pounds of Bi-Con TM-5 per ton of feed to secure the practical supplementation level—possible because the new product has a guaran-



\$210 AN OUNCE

(162D) Redolent of the "skonk works" and purer than Ivory Soap (99.9 percent), is isopropylmercaptan, a rare, evil-smelling chemical being produced by the U.S. Bureau of Mines. Without commercial value at present, the chemical is used as a standard in precision equipment making tests for chemicals in petroleum.

teed terramycin content of 5 g. per lb. Ten g. of terramycin per ton of finished feed was determined to be the most economical and practical

supplementation.

Increases of growth rate, in the Pfizer tests, were measured as of marketing time. Terramycin fortified rations showed an increase of growth of 15 percent in market weight broilers; 10 to 15 percent in turkeys ready for market; and 25 lb. or 10 percent in swine at market weight.

In addition to increasing growth rates of poultry and swine, tests indicated that terramycin feed supplements exerted a protein-sparing effect on the rations of those animals. That is, a lower protein content was required for maximum growth, thus tending to make feeds with antibiotic supplements more economical. In a time of protein shortage, the amount of feed available would be considerably spread.

The mechanism by which antibiotics promote growth in animals has not yet been conclusively determined. Current theories hold that antibiotics favorably influence the flora in the animal's intestinal tract, accentuating assimilation of foods. Should this theory be confirmed. Pfizer spokesmen said, the broad spectrum antibioticsand particularly terramycin-are most likely to achieve universal acceptance in the field of animal nutrition.

TWO-STEP PROCESS:

#### **Anti-Corrosion Primer**

(163A) A moisture and corrosion resistant coating, Primer P-10, has been announced by Prufcoat Laboratories, Inc. It is recommended for anti-corrosion protection for all fer-rous and aluminum surfaces, but is not recommended for phosphate treated, Bonderized or Alox-treated steel. The manufacturer claims that the primer, when used with the A series Prufcoat, provides a simple twostep system for corrosion-proofing old or moist metal surfaces.

DISSOLVES PROTEIN:

#### Crystalline Trypsin

Armour laboratories is already at work on a research program to increase production and to define the usefulness of Tryptar, a crystalline enzyme which has the power to dissolve dead tissue and other protein in wounds and infections, without affecting living tissue.

Tryptar is the brand name for high purity crystalline trypsin, an enzyme produced in the pancreas. It is an or-ganic catalyst which breaks up the protein part of food in the intestine into amino acids.

The company plans to supply the material free of charge to hospitals and clinics. It is expected to be of great service in the treatment of empyema, a complication of tuberculosis.

NON-TOXIC:

#### Safety Solvent

FO 128 is the name given to a new solvent in the line of industrial and fleet automotive equipment maintenance chemicals marketed

by Fine Organies, Inc.

The product is offered for use as a safe alternative for carbon tetrachloride in applications where toxicity or solvent residues are factors. It may be used for the cleaning of both mechanical and electrical equipment parts with complete safety to materials and men. It is available in 53-gal. drums.

#### WIDE TEMPERATURE BANGE: **Lubricating Greases**

(163D) Lubricating greases with use range of -65 deg. to 250 deg. C. have been developed by the Naval Research Laboratory in cooperation with bearing, grease, and motor manufacturers. Key to the new lubricants is copper phthalocyanine, a brilliant blue organic chemical with outstanding heat and oxidation resistance used to gel the lubricant fluids. With silicone fluid base, the grease withstands 250 deg. C.; with synthetic diester oils the grease is expected to permit lifetime Inbrication of electric motors. Copper phthalocyanine greases also stand up under storage much longer than conventional grease, greatly extending shelf-life of in-stock equipment.

#### OIL RESISTANT: Electrical Unit Varnish

After three years of research, the Frederick S. Bacon Laboratories have developed a new impregnating varnish for electrical units which in addition to being oil-resistant does not crack on exposure to -70 deg. F.

This development was undertaken after investigation demonstrated that there were none of the oil-resistant types available which would fulfil the low temperature requirements encountered in aeronautical and military electronic applications. The Bacon Labs have called their new product ABC impregnating varnish.

Field proven over a period of a year on instruments used by the Air Force, the physical properties of films of the varnish applied to brass strips and

Silicone Enamel ...... 162B Electroplating Agent ......163C Isopropyimercaptan ......162D Feed Supplement ......162E Anti-Corrosion Primer ..... Crystalline Trypsin ......163B Electrical Unit Varnish ..... 163F Wetting Agent ......164B Inert Coating ...... 1640 Acidproof Coating .......164D Coating Intermediate .....164E Lead Stearate ...... 

New This Month . . .

Page & Item

Hydraulic Fluid ..... .170A Chemical Intermediate ......172C Pain Killing Drug.....

More Information . . . To find out more about any of these new products, circle the item's num-ber on Reader Service Postcard inside the back cover.

cured 1 hr. at 150 deg. F. plus 1 hr. at 212 deg. F., are as follows:

1. No change in appearance after 48 hr. immersion in chlorinated diphenyl, acryloid resin dissolved in dioctyl sebacate, petroleum base lubri-

cating oil, or fluorocarbons.

2. No change after cold crack test of 15 min. at 150 deg. F., 15 min. at -70 deg. F., 15 min. at 150 deg. F., 15 min. at -70 deg. F.,

The average electrical properties of ABC impregnating varnish areas follow: dielectric strength ( in in. thick) 500 volts/mil; dielectric constant at 60 cycles, 3.3; power factor at 60 cycles, 0.016; loss factor at 60 cycles, 0.05.

#### HIGH TEMPERATURE, PRESSURE: Lubricants

(163F)Liqui-Moly, the first of four new "oil-made-of-metal" lubricants recently developed by the Lockrey Co., is a specially-treated compound of the extremely greasy metal molybdenum. Molybdenum has the peculiar property of attaching itself by molecular attraction to metal bearing surfaces forming a lubricating film that cannot be squeezed out by any amount of pressure and which can withstand extremes of temperature without losing any of its lubricating qualities. The company has perfected a method of incorporating this material in a volatile liquid having the appearance of oil but (Continued)

containing no oil. This liquid serves to transport the metallic lubricant to the bearing-surfaces where the vehicle evaporates off and allows the molybdenum to "plate out" on the bearing-surfaces. The result is a dry but well lubricated bearing, safe at extreme pressures, speeds and temperatures, and having many times the efficiency and life of conventional lubricants. As an example, it is now being successfully used in the hot extrusion of steel at 2,250 deg. F. Bearings can be run continuously at red heat without affecting Liqui-Moly's lubricity or protection of the bearing metal.

Since recent advances in machine design have caused steam and chemical plants to look to higher and higher temperatures and pressures, molybdenum-base lubricants seem to supply the answer where ordinary lubricants

To answer the demand for "wet" lubricants to perform under severe conditions the company is marketing Liqui-Moly NV Regular and Grease. Both are incorporated in a liquid glycol derivative having a very high viscosity index which will pour as low as -25 deg. F. The manufacturer is enthusiastic about its permanence.

Liqui-Moly NV Thread compound takes advantage of the ability of molybdenum to prevent metals from seizing or freezing together under extreme pressure, to provide a thread compound that makes it possible to dis-assemble any piping or equipment after any period of operation at high temperature or under severely corrosive conditions.

Moly-Wax-Stix provide a convenient means of applying this molybdenumbase lubricant in solid form. Typical uses are for filling grooves cut in bushings or thrust washers to feed out moly slowly, to lubricate glass pet-cocks and chemical glassware connections to prevent seizure, to rub on sliding ways to provide lubrication without oiliness.

LOW COST

#### Vinyl Extender

Cycloparaffin product of Halowax Div., Union Carbide and Carbon Co., is a clear, lightcolored liquid with an approximate chlorine content of 40 percent. Manufacturer states that it is widely used as a low cost extender in plasticizer systems for vinyl resins. In this application, the use of moderate amounts of the cycloparaffin results in compounds having improved flame resistance without adversely affecting other properties. It has also been used

in the treatment of duck tentage and paulins used by the armed forces.

The product is soluble in ketones, aliphatic and aromatic hydrocarbons, and in chlorinated hydrocarbons, but is insoluble in water or alcohol. Cycloparaffin 40 is compatible with most natural and synthetic waxes and resins, chlorinated resins and rubber, and most commonly used plasticizers.

#### STRONGER CONCRETE BLOCKS: Wetting Agent

Denser, stronger and (164B)more uniform concrete blocks and bricks result from the addition to the mix of small amounts of a surface active agent, it is reported by Monsanto Chemical Co.

Santomerse S, a liquid wetting agent, permits the use of less water by increasing its efficiency, thus producing a so-called "dry" concrete of greater strength. At the same time the plasticity required to properly mold blocks and bricks is improved.

In addition, the wetting agent is said to result in cleaner equipment, lighter colored products and better dispersion of cement.

INERT: Coating

(164C) Metl-Kote, a product of Corrosion Engineering Co. has to date weathered more than two years of salt brine tests without permitting any corrosion to steel surfaces. When ap plied to wood or steel surfaces, it will not support combustion, flash nor

Manufacturer recommends it for such things as army tanks and navy ships where the above properties would be desirable.

#### ACIDPROOF: Coating

(164D)Unskilled and inexpensive acidproofing of concrete floors, for many corrosive services, is now possible with the use of a brush-on phenol-formaldehyde coating that hardens at room temperature. Carboline Co. is the maker.

In addition to being easy to apply, the new material is two to nine times harder than conventional floor paints according to the manufacturer. Durometer readings are 85 to 90, compared with steel at 100. One primer coat and two finish coats are estimated to last 2 to 3 yr. on steps and other surfaces where considerable walking (but no trucking) takes place.

The new material is called Phe-

It resists organic and inorganic acids, except nitric acid. It is not recommended for alkalis, but so far no solvent has been found to dissolve it.

One coat is 10 mils or 0.010 in. thick. Three coats, properly applied, reveal no porosities under a 30,000-v. spark test. Thickness of coat and innate hardness result in phenomenal wear it is claimed.

Material cost ranges from 10 to 37 c. per sq. ft.

Colors are brick red, chrome green, iron yellow, gray and black.

VERSATILE:

#### Coating Intermediate

A new baking-type coat-(164E) ing intermediate that is expected to form a versatile base for a whole new field of protective coatings has been developed by General Electric's Chemical Dept. Designated as R-108, the new product combines chemical resistance with flexibility and heat resistance. Based on selected phenol derivatives in GE's labs, the material is compatible with a variety of coating resins. Protective coatings formulated with it show good resistance to alkalis, acids, oxidizing agents, solvents, salts, and other corrosive chemicals over a wide temperature range. Other desirable qualities: toughness, flexibility, resistance to abrasion, and unusual stability to aging at elevated tempera-

Coatings formulated with R-108 may be pigmented in a wide variety of colors and are easy to handle and apply. Standard equipment and conventional techniques may be used for applying and baking these new coat-

Production is on a semi-commercial basis, material being available in drum and tank-car lots. Field tests indicate that the intermediate is especially useful in coatings for drums, food containers, tank cars, and chemical tanks and process equipment.

HEAT STABILIZER:

#### Lead Stearate

Lead stearate 50, is a new high lead content primary heat stabilizer and internal lubricant for polyvinyl chloride resins and co-polymers, marketed by the Witco Chemical Co. Both efficient and economical, the product is a stabilizer which will fulfil the total heat protective requirements of most vinyl compounds in which lead salts are suitable. During processing of compounds, the lubricating properties of the lead stearate com-(Continued)





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IF YOU ARE UP AGAINST THE PROBLEM of getting increased productivity from your present filter equipment, here is a suggestion that may help:

Try using Celite\* as your filter aid. One of these efficient powders will probably give you not only the faster filtration you want, but it may improve the purity and clarity of your filtered products as well. Here are some of the reasons why:

- -Celite Filter Aids are accurately graded according to particle size-each grade is designed to "trap out" suspended impurities of a given size and type. From the nine standard grades available, you can select the one that will give you a maximum rate of flow through your filter presses, consistent, of course, with the clarity you desire.
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NEW PRODUCTS, cont. . .

pound contribute to ease of extrusion, mold flow, and release from hot roll and mold surfaces. These latter advantages are not obtainable through the use of ordinary inorganic lead salts and other stabilizers.

ECONOMICAL:

#### Stabilizers

(166A) Two new stabilizers for use in vinyl plastics, Dutch Boy CS-137 and Dutch Boy Barinac have joined National Lead Co.'s list of products. Both are designed for use in clear plastic compounds where exceptional heat and light stability are required.

With the use of CS-137 light and heat stability are obtained with complete freedom from staining by sulphur compounds. It can be used effectively with all commonly-used plasticizers and is especially desirable in calendered film and sheeting, where light-fastness and transparency are important. The product is a sodiumbarium organic complex, economical to use because of its low cost.

Barinae is a new barium ricinoleate for use in products where clarity and heat stability are important. Being a liquid at normal processing temperatures, it is easy to disperse and is especially desirable in calendered and extruded stocks.

The introductory price of CS-137 is \$1 per lb., while Dutch Boy Barinac sells for 66 c. per lb. in standard 100-lb. drum quantities.

CULOR BEPTH:

#### Fluorescent Powders

(166B) Two groups of fluorescent powders for the development of color television picture tubes have been announced by the Tungsten and Chemical Division of Sylvania Electric Products, Inc.

The two groups of TV color phosphors, which are now available in engineering sample quantities, include sulphide and oxide types in the three basic TV colors: red, green and blue. The oxide powders are relatively fine texture while the sulphides are of about the same particle size as those now used in standard black and white picture tubes.

Development of suitable red phosphor material has hitherto presented a problem. Conventional red phosphor mixes have lacked color depth due to relatively low brightness obtained and excessive light output in the green and blue region. A new red phosphor which the division is now making available for color tube development

(Continued)

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#### BENZYL CHLORIDES

Benzyl Chloride Ortho-Chlorobenzyl Chloride Para-Chlorobenzyl Chloride 2.4-Dichlorobenzyl Chloride 3,4-Dichlorobenzyl Chloride

#### RECMIDES

Ammonium Bromide Calcium Bromide Lithium Bromide Fotassium Bromide Sodium Bromide Strontium Bromide

2,4-Dichlorotoluene 1,4-Dichlorotoluene Ortho-Chlorotoluene Para-Chlorotoluene

CHLOROTOLUENES

#### CREOSOTES

Creosote Creosote Carbonate Calcium Creosotate Potassium Creosote Sulfonate

#### FORMALDEHYDES

Formaldehyde Paraformaldehyde Hexamethylenetetramine

#### FORMATES

Furmic Acid Sodium Formate

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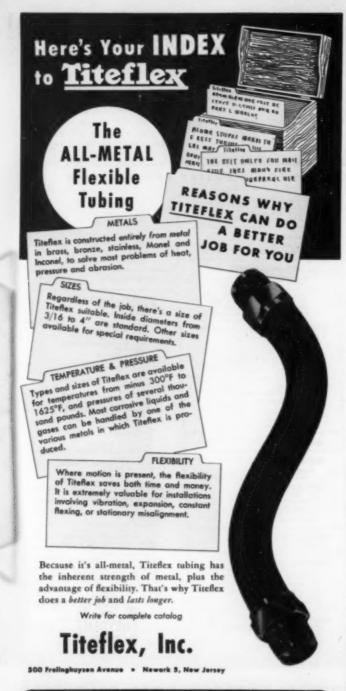
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Pentaerythritol Diocetal
Pentaerythritol Diocetal
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FLEXIBLE TUBING NEEDS TO A

New Products, cont. . .

is a manganese activated zinc phosphate. It represents a marked improvement over powders hitherto available.

CUBARE-LIKE:

#### Anesthetie

(168A) Pharmacological experiments with a new curare-like drug developed by Sterling-Winthrop give promise of providing an improved tool to surgeons performing major operations.

Major surgery requires relaxation of the voluntary muscles, now achieved by the use of p-tubocurarine chloride, an alkaloid obtained from curare, the ancient South American arrow-poison. Prior to the advent of p-tubocurarine it was necessary to resort to the use of large amounts of anesthetic in order to obtain adequate muscular relaxation but frequently this reacted unfavorably on the blood pressure and respiration.

The new synthetic, described chemically as 2,5-bis (3 diethylamino-propylamino) - benzoquinine - bisbenzylchloride, was found to have curare-like activity ranging from one half to five times as great as p-tubocurarine. Tests were performed on several species of laboratory animals. Necessary relaxation of the voluntary or skeletal muscles was obtained with smaller amounts of the new compound, reducing many objectional effects of deep anesthesia.

POSSIBLE FUNGICIDE:

#### 2-methyl-1, 4-napthoquinone

(168B) A highly reactive compound, 2-methyl-1,4-napthoquinone, is being offered in experimental quantities for market development purposes by the Velsicol Corp. The chemical has displayed a high degree of effectiveness as a bacteriostatic and fungicidal agent, indicating that the compound or its derivatives may be used in phases of food packaging and processing, cosmetics, pharmaceuticals, wood treating chemicals and textile and leather industries. It has also gained attention as a vitamin K-active substance (anti-hemorrhagic activity), whose potency is markedly greater than that of natural vitamin K.

Petroleum Wax

(168C) Syrex 200, produced by the Velsicol Corp., is a petroeum wax soluble in many common solvents. It has been called a new approach to polish formulations without any hard vegetable wax, is satisfactory also as a (Continued)





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Provide Positive Seal . . . Retain Flexibility Despite High Temperatures and Pressures

Here's a seat gasket cut from Ebonite Sheet Packing that rolled up thirteen years of trouble-free service on a pop-off pressure re-lief valve in a southern plant . . . withstandlief valve in a southern plant . . . withstand-ing high temperatures and pressures . . . eliminating leaks and shutdown time...asur-ing absolute safety. Only extensive changes requiring different sized gaskets made it necessary to replace this gasket at all! Performance like this is made possible be-cause of Ebonite's remarkable leak-proof characteristics and the fact that it will not

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carbonise, melt or become hard. That's why Ebonite is ideal for high pressure joints and flanges; for use with superheated steam, ammonia, brine, air, oils, acids, caustics, gases, hot or cold water.

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You are assured of uniform, constant production and quality from any process...steady, reliable operation...lower cost for more dependable cooling. You can have closed system cooling with freedom from scale, dirt, corrosion and maintenance troubles. You can accurately cool more than one type of liquid with one machine.

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling. You can remove heat at the rate of input to keep accurate control of gas or liquid temperature. You can put heat back into the system to save the losses of a "warm-up" period or to equalize the effect of load variations.



Great savings in cooling water and savings in piping, pumping and power return the cost to you quickly. The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 96. New Products, cont. . .

hard wax replacement in marking crayons, carbon papers, heat transfer inks and electrical insulation compounds. The manufacturer has conducted tests with formulations using the new product as an extender in polishes and protective coatings. Indications are that no lowering of quality results, but rather an actual improvement in durability, transparency and luster of films is obtained. One of the most attractive features of the new wax is its price, 25-30c. per lb.

#### NON-FLAMMABLE: Hydraulie Fluid

(170A) Hydraulic Fluid F-9, offered by Monsanto, is a non-flammable product developed primarily for use in equipment such as die casting machines, hydroelectric turbines, glass drawing machinery, hydraulic presses and similar applications.

It is said to have an excellent combination of properties: good fire resistance, good lubricity and pum ing characteristics, high resistance to mechanical shear and chemical breakdown, and inertness to the common metals of construction.

F-9, like many of the newer hydraulic fluids, exerts a swelling action on some elastomeric materials and has a solvent action on some paints. Suitable packing and gasket materials and resistant coatings are available however, and it is recommended that they be used wherever those actions of F-9 cannot be tolerated.

#### Solvent

(170B) Solvent 62, a mixture of methanol, esters, low-boiling aldehydes and acetals, is the latest product from the chemical div. of the Quaker Oats Co. Priced at 8 c. per gal. in tank car quantities, the yellow to amber liquid may be useful as a low cost extender for alcohols, ketones and esters both as a solvent and as a coupling agent.

Although substantially anhydrous, Solvent 62 is soluble in water and common organic solvents. Many commercial resins are soluble to the extent of 6 percent or more in the product.

#### Aluminum Phosphates

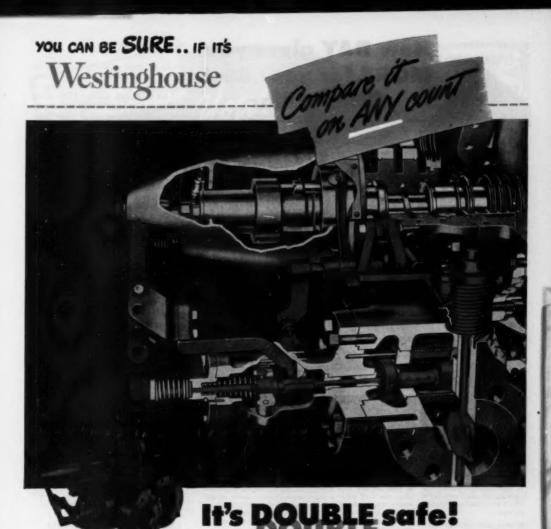
(170C) A series of aluminum phosphates ranging in physical form from dry solids to water solutions of high concentration is being offered by Monsanto Chemical Co. These (Continued)

Over 35 Years Service in Industrial Air Engineering

Dept. CE, 405 Lexington Ave.

New York 17, N.Y.

Experienced District Engineers in all Principal Cities



With Type E turbines, you can be doubly sure of protection against overspeed.

A sensitive, powerful centrifugal-weight governor, enclosed in a specially shaped housing, provides extremely accurate speed control.

However, if for any reason the governor loses control, Type E dual protection takes over. A corrosion-resistant, spring-restrained weight, mounted in the governor hub, strikes a trip link-age... instantly closes the governor valve and an independent steam inlet butterfly valve. Steam is cut off positively... danger is avoided.

Dual protection is but one of the many signifi-

cant features of Type E turbines. We invite your comparison on any count. Ask your nearby Westinghouse office for 20-page book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50499-A



#### How DAY gives you MORE for your dust filter dollar

The maked dust on on hand control of the of let of be to-clificter ping

The DAY Type "AC" Dust Filter helps make important savings two ways in your dust control program. First: you save money on original cost because you buy less filter to handle equal volumes of air. With DAY's continuous-automatic operation, only 1½% of the filter cloth is lost for cleaning instead of losses up to 50% which occur in most other types of filters. Also, DAY's gentle, reverse air-jet cleaning action permits use of better filtering fabrics for a greater air-to-cloth ratio. Thus less cloth and a smaller filter do the same job as much larger rapping type units.

Second: economy stems from the DAY filter's compact design. Less floor space is needed and installation costs are minimized. Its simple, rugged construction gives years of dependable service at rock-bottom maintenance costs...economy all the way.

New Products, cont. . .

products, trade-named Alkophos, are offered as bonding agents for refractories, for high temperature cements and for refractory paints. They afford good green strength which makes possible molded shapes set in place without firing and fired in place to yield high temperature non-slagging refractories.

In certain quick setting applications, they may be used with a proportion of alkaline materials such as asbestos or tale. In general, these products are not stable in the presence of alkaline materials and should not be used with them.

#### Plastic Tape

(172A) A heavy-duty plastic film tape is available commercially from the Minnesota Mining and Mfg. Co. Features are high temperature resistance (softening point, 240 deg. F.), and good abrasion resistance. The tape will also hold its seal against acids, alkalis, salt solutions and most solvents.

#### Polystyrene Foam

(172B) Styrofoam, a snow-white, expanded poystyrene foam made by Dow Chemical Co. is finding increased use as a buoyancy medium by boat builders. The multicellular structure of the material provides a water barrier which allows the material to float 55 lb. per cu. ft., and it does not swell or soften upon exposure to water.

Useful in all types of craft, the material also found extensive use in World War II in life rafts, life preservers and other rescue equipment.

#### Chemical Intermediate

(172C) 12-Hydroxystearic acid, a product of Emery Industries Inc., is a chemical with unusual properties. Reactivity is due to the hydroxyl group on the twelfth carbon. Uses suggested are esters, soaps, and alkanol amine salts. One maker is using it successfully in lithium-based lubricating greases.

#### Pain Killing Brug

(172D) First report on a new pain killer for severe menstrual conditions and headaches was made by the Sterling-Winthrop Research Institute. The new analgesic, known chemically as N-(2-(2-pyridyl)-ethylphthalimide, was found to be three times more effective than aminopyrine, also known as pyramidon.

—End

#### THESE ADVANTAGES MAKE THE DIFFERENCE



A. Reverse air-jet cleaning rings

travel up and down the tubes of

B DAY filter, constantly cleaning

B. Most other types of filters

must shut off a complete section for cleaning or rapping. This may amount to 50% of the cloth

the cloth,





A. Back pressure rises slightly when the DAY filter is first storted, then levels off and remains uniform. This assures the constant oir volumes necessary for efficiency fell filtering clath.

7. Topober either with constant of the pressure of the pressu

B. Shorp back pressure and air valume variations occur in repping type filters when sections are shot down for cleaning.

8. Tougher cloth with resultant poarer filtering must be used in rapping type filters. Cleaning effectiveness varies widely from point of vibration to where cloth is attacked to filter.

#### Other Important Advantages

Separated Dust Streams — One DAY Type "AC" Dust Filter can handle several different product streams simultaneously without mixing . . . thus doing the work of several individual units.

No Dust-Catching Ledges—DAY filters have no flat surfaces or ledges where dust can collect and become contaminated . . no places to encourage infestation.





The DAY Company

856 3rd Ave. N. E., Minneapolis 13, Minn. IN CANADA F. O. SOX 70N FORT WILLIAM, ONTARIO BRANCH PLANTS IN FT. WORTH, BUFFALO AND WELLAND, ONTARIO



# Streamlined THE REDUCING VALVES

Streamlined flow of steam, air, ail, etc., around the inner valve is an immediate solution to the important need of dependable control under varying loads.

Continuous processes can be dependably protected against allow downs. failures, and maintenance ordinarily due to valve inefficiencies. The STREAMLINED yet hold the reductioning characteristics, close delivery for Bulletin "1000."

pressure control, and with a wide range of adjustment makes possible speedier production, smooth operation and no spoilage.

You get straight line flow which eliminates turbulence so that at all times you are easily able to meet peak demand and yet hold the reduced pressure constant at the same time. For the complete facts write for Bulletin "1000."



A. W. CASH COMPANY





High Pressure Reducing Valve Type H-P; extra heavy for eas with initial pressures up to 500 lbs.; and for reduced pressures up to 450 lbs. Good for most falets. Since: 14" to 2"; brease hody; altralloy trim. Get Bulletin 931.



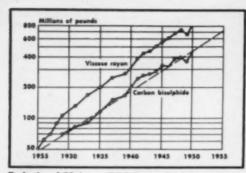
Type 8871 Pressure Regulator for dirty liquids (like Bunhar C feel oil). Inner varive in belted the disstraym for positive movement. Sizes 15.11 to 1011. Budless; Iron, broase, or steel. Soul ring and inner varive; stainless steel. Bullatio 472.



Cash Standard Type 10 Pressure Regulating Valve, pilet operated. Iffliot operating filled discharges to entire pipe; not wested), Sizes: 2" to 12". Highest pressures: intot 600 lbs.; reduciód 256 lbs. tree, broase, or steel bedies; standard frims. Far kenter, sir, non-corresive gases and oils. Get interestina Ralletin 640.



VALVES



Production of  $CS_n$  has paralleled the growth of viscose rayon in the United States. But other uses are large.

Raw materials per ton of CS,	(theoretical basis)
Charcoal	315 lb
Sulphur	1,685 lb.
Furnace characteristics	
Copacity	260-330 kw.
Current	4,000-6,000 amp.
Emf.	60-150 v.
Energy used	0.4-0.5 kwh. per lb.
Operating temperatures	1,450-1,850 deg.F.

Engineering details shown here do not represent operations at Penn Yan. They are typical industry averages.

# Carbon Bisulphide



J. T. Baker Chemical Co. operates the Taylor process for the manufacture of carbon bisulphide at Penn Yan, New York.

About 1900 Dr. E. R. Taylor conceived and patented the process and chose the present location for the plant because of available water power for the production of cheap electric power. This marked the first attempt

to produce bisulphide on a large scale by electric furnaces. The electrothermal process uses molten sulphur, lump charcoal and polyphase electric power. Crude lump sulphur is melted outside the furnace and is fed to the base section to form a pool. Lump charcoal is fed through the top of the furnace through a bell valve and is maintained at a predetermined level. Graphite electrodes are located in the base section to provide contact with incoming charcoal. The polyphase electric power is applied to the electrodes to heat the charcoal to the desired temperature and vaporize the sulphur.

The sulphur vapors contacting the hot charcoal combine to form the product together with other polysulphides given off as impurities. The gases pass up through the column of incoming charcoal, releasing a large proportion of their heat, and out of the top of the furnace to dust separators and pressure relief traps. The carbon bisulphide vapors are condensed by water spray, brine and ammonia cooled condensers. Noncondensible gases and vapors pass through to the sulphur recovery system and waste gas stack. The condensed liquid flows through water separators to measuring tanks and is then pumped to the distillation system for removal of all impurities.

The purified product is pumped to underground finishedmaterial storage tanks for withdrawal and shipment in tank cars and steel drums. All carbon bisulphide is stored under water and transferred to tank cars and drums by displace-

Carbon bisulphide is a widely used industrial chemical. A major portion of the entire output is required in the manufacture of rayon. The manufacture of carbon tetrachloride consumes the second largest quantity. The production of cellophane and dyestuffs also requires considerable quantities of carbon bisulphide. It is used as a solvent for rubber, phosphorus, sulphur, fats and oils, compounding of varnish and lacquers and as an insecticide.

Carbon bisulphide is also used as a raw material for many other chemicals.



Plant employs the electric furnace, receives charcoal and sulphur by rail. Note sulphur pile in center of plant area.

# FOR SAFER CONTROL OF CHEMICAL FLUIDS

## USE THESE CRANE HEAVY DUTY ALL-IRON VALVES

Crane Ferrosteel valves—recommended especially for ammonia service—are also ideal for process piping that requires heavy duty valves of all-iron and steel materials. Special Crane seating design and rugged construction combine to make these valves highly effective for safe and economical handling of hazardous or noxious liquids and gases. They minimize the danger of costly fluid losses with important features like these:

- TIGHT SEATING—two disc-seat combinations available: (1) special lead-faced disc and integral body seat rings; (2) steel disc and renewable steel seat rings.
- EXTRA-TIGHT STEM SEAL—Unusually deep stuffing box is filled with high grade packing. Machined "back seating" shoulder on stem relieves internal pressure on packing, further assuring a pressure-tight stem seal when valve is wide open.
- RUGGED CONSTRUCTION—Heavy, massive metal sections in body help resist distortion; long sweeping interior body contours reduce flow resistance.
- LEAKPROOF END CONNECTIONS—Flanged valves have tongue and groove faces for greater tightness and to protect against gasket blowouts. Screwed valves have long threads with a recess for soldering joints.
- companion lines of check valves, fittings and specialties of equally outstanding Crane design are available. Fully described in your Crane No. 49 Catalog. Or see them in Crane Circular 320 on Corrosion-Resistant piping materials—your copy supplied on request by your Crane Representative.

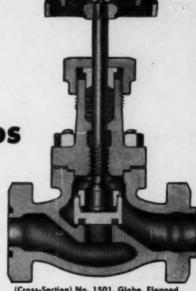


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CRANE

**VALVES . FITTINGS . PIPE . PLUMBING AND HEATING** 

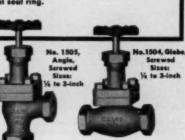


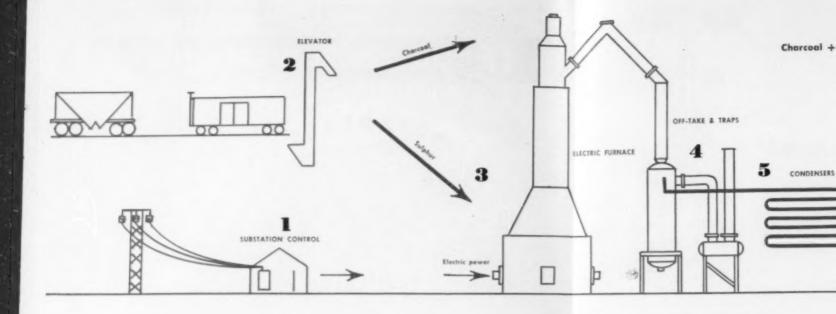
(Cross-Section) No. 1501, Globe, Flanged Working Pressures: 300 pounds ammonia; 500 pounds oil, gas, or air up to 100° F. Sizes: ½ to 4-inch. Tested at 300 pounds Air-under-Water

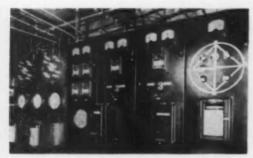
#### CHOICE OF TWO TIGHT-SEATING DESIGNS

Crane special leadfaced disc—with facing securely rolled into machined devetail—seats against crowned face of integral body seat to assure tightness in service. Where temperature or corrosive action does not allow use of lead, these valves can be supalled with a case band

these valves can be supplied with a case-hardened steel disc and steel seat ring.



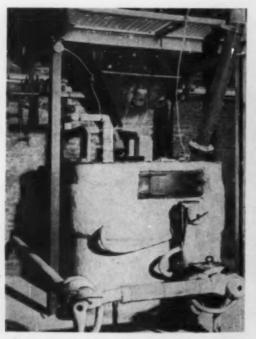




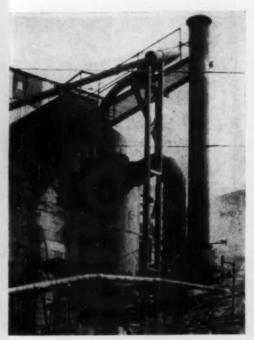
Switchboard panel for controlling electric power input to furnace is a nerve center in operation of plant.



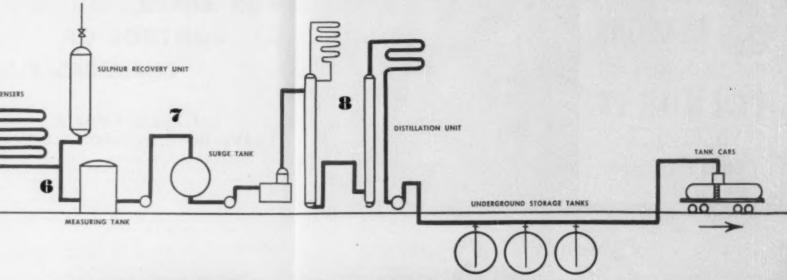
Crusher, elevator and conveyor are used to unload sulphur and charcoal and carry them to storage or process units.



Hopper and melter where crude sulphur becomes molten feed stock for the electric furnace where CS<sub>2</sub> is formed.



Gas offtakes and traps remove solids from crude CS, coming out of furnace. They also relieve excess pressures.





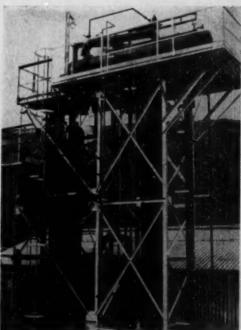
5 Coils are sprayed with water to cool carbon bisulphide after it passes through offtake and traps.



Refrigerated towers further cool the crude product before sulphur removal and prior to storage in isolated tanks.



7 Crude feed, surge and measuring tanks are mounted on concrete. They supply feedstock to refining operations.



Two distillation towers refine the crude product. Purified CS, goes to underground tanks or tank cars.



For Choosing

### TOLHURST SUSPENDED CENTRIFUGALS



#### SPEEDIER

Tollurst two-speed drive and basket unloading plaw permit shorter operating cycles and increased production.

# 2

#### **SMOOTHER**

Aperiodic mounting, exclusive with Tolhurs? Suspendeds, permits smooth operation even with ext-of-balance loads.



#### SAFER

Tolhurst Suspendeds are carefully designed, procision-built and rigidly tested. You can rely on Tolhurst's 98 years experience.



Tolhurst Suspended Centrifugals are equally efficient whether slow or fast starts or repeated short cycles at full speed are required. Baskets can be perforate or imperforate, constructed of steel, steel rubber covered, stainless steel, monel and other alloys. Basket diameters: 26", 32", 40" and 48".

WRITE FOR ILLUSTRATED CATALOG TC-3-48.

#### DO THESE 6 JOBS FASTER MORE ECONOMICALLY

FILTERING CLARIFYING
DRAINING THICKENING
DEHYDRATING SEPARATING

#### TOLHURST CENTRIFUGALS

Division of AMERICAN MACHINE AND METALS, INC

EAST MOLINE, ILLINOIS

In Canada: American Machine and Metals (Canada) Ltd., 1144 Westen Road, Toronto 7, Ontario

#### 178

# FOR SAFER CONTROL OF CHEMICAL FL

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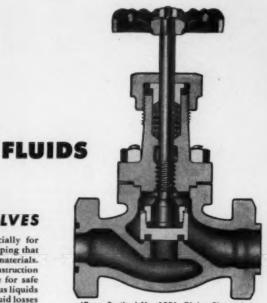


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EVERYTHING FOR EVERY PIPING SY

# CRAN

VALVES . FITTINGS . PIPE . PLUMBING AND H



(Cross-Section) No. 1501, Globe, Flanged Working Pressures: 300 pounds ammonia; 500 pounds eil, gas, or air up to 100° F. Sixes: 1/2 to 4-inch. Tested at 300 pounds Air-under-Water

CHOICE OF TWO

TIGHT-SEATING

DESIGNS

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ID HEATING

LVES cially for ping that naterials. struction for safe as liquids aid losses

(1) spe-

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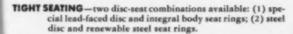




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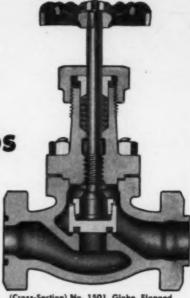


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**VALVES · FITTINGS · PIPE · PLUMBING AND HEATING** 

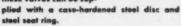


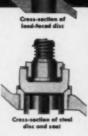
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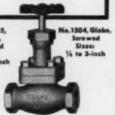
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# Chemical Engineering News Educa ber Soseph A. O'Connor



#### Du Pont May Try to Make Tritium at New AEC Plant

Tritium, the extra-heavy hydrogen isotope that seems the best bet for production of an H-bomb, almost certainly can be made by transmuting lithium in big atomic reactors at the new \$260 million plant that E. I. du Pont de Nemours & Co., Inc., will build and operate for the Atomic Energy Commission in South Carolina. Alternatively, these same reactors can produce plutonium for present A-bombs. No completed atomic weapons will be made at the new plant, however.

SITE

After four months of studying more than 100 sites, Du Pont picked the 250,000-acre area in South Carolina on the Savannah River. The location is about 20 miles southeast of Augusta, Ga. (see map). Five top engineers, appointed by AEC to a site review committee, backstopped Du Pont's recommendation. Du Pont should know, it built and operated the wartime Hanford, Wash., plutonium plant.

#### EXPANSION FUNDS

Money needed to start construction was included in a supplemental appropriation passed by Congress last September. President Truman already has asked for another \$1 billion from the lame-duck Congress to speed work at the new site and at other sites just chosen. Another new \$500 million plant will be built at the Kentucky

Ordnance Works near Paducah, Ky., to produce U-235 for atomic weapons; Carbide & Carbon Chemicals Division of Union Carbide & Carbon Corp. will operate this giant gaseous diffusion plant; five power companies will jointly supply its power. Normally, AEC spends about \$1 billion a year for all its operations.

#### CONSTRUCTION

Construction at the Savannah River plant gets under way early this year; 8,000 construction workers will swarm over the site during the first six months, three times as many in a year. Robert K. Mason, Du Pont's field construction manager, was among the first on the scene. Steps are being taken to obtain rights-of-way for railroad spurs, roads and utilities needed for the big construction job. In addition, about 1,500 families, totaling some 5,000 to 8,000 people, most of them small farmers and sharecroppers, will have to leave the sand hills and pine barrens of South Carolina's Barnwell and Aiken Counties. The government will purchase their farm and timber land at prices that may average \$50 an acre. Their move will make way for the plant and its surrounding security and safety zone, which will embrace 375 square miles. AEC emphasizes that protective measures followed heretofore have been so effective against radiation hazards that atomic plants have a better safety record than industry generally.

Curtis A. Nelson, manager of Savannah River operations for AEC, and Robert C. Blair, his deputy, have already opened their office.

#### HYDROELECTRIC POWER

Decisive elements in selection of the site were an abundant water supply and plenty of hydroelectric power. It will take an estimated 6,000,000 gal. per day of water just to cool the reactors. AEC has not decided whether to purchase or to generate the enormous power required. The Department of Interior's Southeastern Power Administration is likely to be called upon to supply some of it.

First units of the Clark Hill Dam

First units of the Clark Hill Dam on the Savannah, above the site, will be installed in 1952. Clark Hill, under construction by the Army's Corps of Engineers, will have a capacity of 280,000 kw. by 1954. Hartwell, another Savannah dam for SEPA, to be constructed by the Corps, will have an initial installed capacity of 177,300 kw. First power is due in 1953.

kw. First power is due in 1953.

Allatoona Dam on the Etowah River in Georgia presently has 74,000 kw. of capacity and an ultimate of 110,000 kw. Buford on the Chatta-horchee River in Georgia is scheduled for 1955. Initial installations are to produce 43,000 kw. and the ultimate is 86,000 kw.

In all, SEPA—by the end of 1954—will be marketing 480,000 kw. from three dams within reach of the new AEC installation and another 173,300 kw. could be provided within a few more years. The high priority of the Savannah River plant in the nation's defense program may spur Georgia-South Carolina power projects.

#### DECISIVE FACTORS

Four important factors bearing heavily upon the atomic site selection were: (1) military defense against attack; (2) operating requirements (mostly undisclosed for security reasons); (3) access to population centers (to avoid establishing another government community); and (4) public health and safety.

The new plant is expected ultimately to employ upwards of 6,000 technicians and workers. Don A. Miller of Du Pont will be works manager of the creating aleat of the creating aleat

of the operating plant.

This project is part of the attempt to produce a more terrible weapon (Continued) News, cont. . .

than the A-bomb. There's a limit on the size of a fission bomb: as it begins to exceed the critical mass, it blows up in about half a millionth of a second; if it is smaller, it cannot be exploded at all. Uranium and plutonium bombs are getting close to the limit on power. If you want bigger and better bombs, you have to look for other nuclear processes.

#### FUSION PROCESS

Stellar temperatures cannot be maintained on earth. But the explosion of a fission bomb of uranium or plutonium creates, momentarily, the temperatures of 20 million degrees Centigrade and higher required for thermonuclear reactions. At temperatures like these, atomic particles move fast enough to burst through the barrier of electrical repulsion and fuse with each other, releasing tremendous energy.

There's no hope of a continuous self-sustaining fusion process. The hotter anything gets, the faster it radiates heat away. So any small body would cool itself off far faster than the nuclear fusions could generate more heat. To get a self-sustaining "fire," you'd need a body the size of a star.

But it looks as if, during the fraction of a second that a fission bomb is exploding, enough fusions could take place to generate enormous extra energy. Fuel for this fusion process could be provided by packing the rarer, heavier isotopes of hydrogen around an A-bomb, thus multiplying its effectiveness many fold. And critical size no longer imposes an upper limit. The A-bomb "fuse" itself must be made overcritical to explode, but once it does, what happens depends only on how much fuel there is for the fusion reaction.

How much energy can you get before the thing cools off? The helium nucleus—two protons and two neutrons—is an intensely stable one, so much so that particles of larger atoms tend to group themselves in fours. This means you get maximum energy by fusing hydrogen nuclei into the heavier and more stable helium.

#### HYDROGEN BOMB

The so-called "hydrogen bomb" most likely is one of two different bombs, neither of them, strictly speaking, a hydrogen bomb. Of these two, the deuterium bomb that would really be valuable probably won't work. And the tritium-deuterium bomb, which is likely to work, is of debatable value. Here's why:

Ordinary hydrogen fuses into

helium only in a series of steps that take millions of years. The two hydrogen isotopes that could be made to fuse into helium at high temperatures are: (1) deuterium, or H-2, which consists of a proton and a neutron; and (2) tritium, the radioactive but long-lived isotope H-3, which has one proton and two neutrons.

Deuterium fuses with deuterium in two ways, each releasing about the same energy. When two nuclei of deuterium come together, they yield either (1) tritium, a proton and 4 mev.; or (2) the light He-3 isotope, a neutron and 3.2 mev. of energy.

The tritium-tritium reaction yields a nucleus of He-4 and two neutrons. It also generates about 11.4 mev., more energy than the deuterium-deuterium fusion liberates but less than the tritium-deuterium reaction gives up.

Tritium-deuterium fusion releases more energy than any other reaction involving these heavy isotopes of hydrogen. When these two nuclei fuse, they form He-4, emit a neutron and free 17.6 mev. of energy. Unlike the reaction of a neutron and a plutonium nucleus, this fusion doesn't touch off a chain reaction.

#### TIME CRUCIAL

The crux of the matter comes back to time. The high temperature needed for any reaction can be maintained for only a tiny fraction of a second. The fusion reaction must take place during that short interval. A pair of deuterium atoms at 20 million degrees Centigrade can fuse in something like

eight thousandths of a second; it's unlikely that this would be fast enough.

The tritium-deuterium reaction is slightly more than 19 times as fast as the deuterium-deuterium reaction at 20 million degrees Centigrade and looks really hopeful. Almost certainly, a tritium bomb, or more likely a tritium-deuterium bomb, is the only one worth fooling with right now.

This is unfortunate. Deuterium as a nuclear fuel would make a cheap and valuable addition to atomic armament. One part in 5,000 of natural hydrogen is deuterium, and it can be separated in large quantities by electrolysis of water.

#### MAKING TRITIUM

Tritium is another story. It doesn't occur in nature at all; it must be manufactured. And you have to manufacture it in uranium piles of the Hanford type, competing directly with manufacture of plutonium.

The process starts with the light metal lithium. One part in 10 of natural lithium is the light isotope Li-6. Separating this is not necessary, since Li-6 captures neutrons much more readily than the more plentiful

The lithium would have to be inserted in a uranium pile to be bombarded with neutrons. Each time a neutron hit a Li-6 atom, it would form an atom of helium, of no particular use, plus an atom of tritium, fuel for a bomb.

To load tritium (or deuterium (Continued)

#### LITTLE BONERS



Sand to Iran

The company was having a bit of trouble. It had taken on a major construction job in the Near East. Getting equipment and supplies on the job was a headache, for everything—down to nuts and bolts—had to be shipped in from the United States. The order went out from top brass that the delays must be eliminated, that all equipment had to be on location on time. There were to be no ifs and buts.

Things were straightened out, everything went beautifully. Equipment and supplies were on hand when needed. The job rolled along.

It was some nine months later that an alert purchasing agent found out how damned efficient—and expensive—the supply job had been: thousands of tons of sand had been shipped some 7,000 miles from the United States to the Arabian desert.

Yessir, it really happened. Time has mellowed it into a company joke—but a joke that still isn't told very often to outsiders (and one that's verbores even to think about in Iran). Watch for other "Little Boners" to come.

# cupric chloride

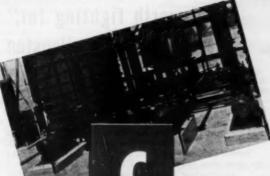
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either, for that matter) into a bomb, you have to liquefy it to make it compact enough to feel the full effects of the uranium "fuse." This means cooling it to within a few degrees of absolute zero and keeping it cold until the time it is exploded.

Finally, unlike plutonium, tritium cannot be stored indefinitely. It is radioactive, and half of it destroys it-

self every 12 years.

#### DRAW BACKS

If a mixed tritium-deuterium bomb can be made to explode, and with about the same efficiency as plutonium, production of superbombs 10 times as powerful, say, as a modern A-bomb would require an industrial effort something like this: (1) production of about half a ton of lithium metal per bomb; (2) several huge atomic reactors, similar to those at Hanford, to transmute the Li-6 into tritium; and (3) much development work on extreme refrigeration.

It's that second point that's the hard one. The Hanford plant cost \$350 million and produces, the Smyth Report hints, about two pounds a day of plutonium. An equivalent plant would take more than two years to make enough tritium for one bomb

Meanwhile, a 10-power bomb will not be 10 times as destructive as an A-bomb. Actually, where a Hiroshimatrype A-bomb gave a radius of effective destruction of about a mile, and a modern bomb a radius of a little under two miles, a 10-power bomb would have a destructive radius of perhaps five miles.

equivalent to 10 A-bombs.

In pure economics of destruction. the deal doesn't look too favorable. However, the psychological and political effects of even this supposed tenfold increase in bomb power would be tremendous. And, militarily, the chance of destroying a small high-priority target under difficult aiming conditions would be increased.

#### SPEEDUP ON A-BOMBS

Right now, the hydrogen bomb is in the headlines. But meantime this country is also answering Russia's atom bomb achievement in another less dramatic way: an intense speedup of plans for expanded production of the two A-bomb explosives, U-235 and plutonium.

Construction originally expected to stretch over three to five years is being condensed into a couple. Bomb production is probably substantially higher than the 50-a-year estimate of several years ago. By the end of 1951, it may well be doubled.

(Continued)



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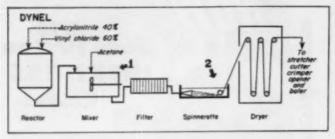
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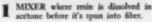
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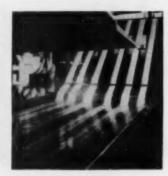
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2 BATH whence dynel emerges as tow, which is later cut into staple.

#### Dynel, Carbide's New Acrylic Fiber, Outstrips Capacity at Start of Its Commercial Career

Dynel, the new synthetic fiber made by the Carbide & Carbon Chemicals Division of Union Carbide & Carbon Corp., is off to a flying start. Orders for the soft, wool-like fiber are already outstripping current annual output of 2 million pounds. Today, Carbide is doubling capacity at Charleston, W. Va., and within six months will be producing 4 million to 5 million pounds. And if that isn't enough, Carbide stands ready to build a huge plant that could make as much as 40 million pounds a year.

#### RAW MATERIALS

Best of all, from Carbide's standpoint, is the fact that the company is a big producer of the raw materials from which dynel is made. Its new fiber is made from acrylonitrile and vinyl chloride. Every year Carbide turns out millions of pounds of the raw materials used to make these chemicals.

#### VINYL CHLORIDE

Carbide is the biggest manufacturer of acetylene, from which it makes lots of vinyl chloride for vinyl plastics. Of the 300 million to 400 million pounds of vinyl plastics made each year by the entire industry, Carbide accounts for some 150 million to 160 million pounds. It is the biggest producer of vinyl plastics. So, for making dynel, it has plenty of vinyl chloride capacity.

#### ACRYLONITRILE

When it comes to acrylonitrile, the other dynel ingredient, bear in mind that Carbide is the country's biggest maker of ethylene oxide from natural gas. Ethylene oxide is needed to make acrylonitrile. Right now, American Cyanamid Co. is the only maker of acrylonitrile. But Chemstrand Corp. plans to make it. And Carbide intends to manufacture acrylonitrile itself in a new plant in Texas.

#### PROCESS

Here's how Carbide makes dynel: the resin is polymerized from a mixture of monomers that contains 60 percent vinyl chloride and 40 percent acrylonitrile. The resin is converted into staple in a continuous process, not unlike those used for wet-spinning other synthetic fibers.

The white resin powder is mixed with acetone to produce a dope solution. This is filtered and extruded through spinnerettes into a water bath. Tow is collected, dried and stretched. It can be used in that form for certain purposes. But most of it is cut to the desired staple length, crimped, stabilized and opened. It is finally packaged and shipped in 300-lb. fiberboard bales.

#### COST

Dynel, even in its present limited production, can be sold at \$1.25 a lb. Nylon, now made in millions of pounds a year, sells at \$1.75 a lb. Wool, which both these fibers can replace pound for pound, now brings \$3.35 a lb.

#### WOOL SUBSTITUTE

With the top brass in Washington, D. C., worried about the squeeze in wool, there's the possibility that dynel may find military uses. This would call for expansion costing hundreds of millions. And the supply of raw materials for making dynel would have to be increased.

#### PROPERTIES

But dynel wasn't developed to compete with wool directly. The synthetic combines the texture and warmth of wool with other characteristics: it's non-flammable and won't support combustion; it's washable, almost shrinkproof and holds its shape; it's fast to sunlight and withstands mildew, fungi, moths and other insects; and it's resistant to strong chemicals. The new fiber is expected to move into fields that wool hasn't even touched. So far, its commercial inroads have been into fields previously exploited by wool and nylon.

In its natural form, dynel is honeycolored, but it can be bleached or dyed white, or dyed a full range of colors. Most acetate dyes, a number of acid dyes, many direct dyes and some vat dyes can be used.

Properly treated dynel fabrics are shrinkproof up to about 240 deg. F. At any higher temperature, it will shrink once, not shrink again until it encounters a higher temperature. This thermoplasticity makes it possible to set pleats and creases in the material during manufacture.

#### STAPLE

At present, dynel is available only in the staple form. The continuous filament form, which goes by the name of Vinyon N, is still in the experimental stage, with experts trying to improve the manufacturing process.

INDUSTRIAL USES

With the development of the staple, however, Union Carbide thinks it has hit the jackpot. A whole rash of dynel applications will hit the market within the next few weeks. Many will find use in the chemical process industries. Among them: filter cloths, water-softener bags, dust-fume bags, acidresistant work clothes.

#### Cutbacks in Sulphur for Consumers Expected by NPA

Some action will have to be taken soon for dividing the available sulphur between U. S. and foreign consumers.

National Production Authority of-ficials say that several government agencies are considering how much sulphur must be exported in 1951 to avoid undue hardship to friendly nations that depend on U. S. supplies. (Continued)

#### CONVENTION CALENDAR

Society of Plastics Engineers, national technical conference, Statler Hotel, New

York, January 18-20. American Society of Heating & Ventilating Engineers, 57th annual meeting and

10th Heating & Ventilating Exposition. Commercial Museum, Philadelphia, January 22-26.

Instrument Society of America, New York Section, Process Control, Hotel New Yorker, January 26-27.

Society of the Plastics Industry, Reinforced Plastics Division meeting, Sixth annual technical session, Edgewater Beach Hotel, Chicago, February 28-March 2.

Pittsburgh Conference on Analytical Chemistry & Applied Spectroscopy, William Penn Hotel, Pittsburgh, Pa., March 5-7.

American Society for Testing Materials, spring meeting and committee week, Cincinnati, March 5-9.

Drug, Chemical & Allied Trades Section, New York Board of Trade, 25th annual dinner, Waldorf-Astoria Hotel, New York, March 8.

American Institute of Chemical Engineers, regional meeting, Greenbrier Hotel, White Sulphur Springs, Va., March

National Association of Corrosion Engineers, conference and exhibition, Statler Hotel, New York, March 13-16.

Seventh Western Metal Show, American Society for Metals, Civic Auditorium, Oakland, Calif., March 19-23.

American Wood-Preservers' Association, annual meeting, Stevens Hotel, Chicago, April 24-26.

Materials Handling Exposition, International Amphitheatre, Chicago, April 30-May 4.

## NEW R·C EXHAUSTER pays its own way

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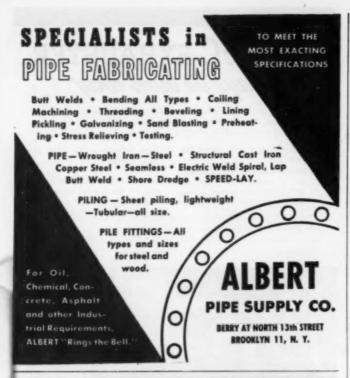
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News, cont. . .

Development of foreign pyrites sources is not considered a solution by government spokesmen. It will take too long. NPA thinks that it may be necessary to limit sulphur going to consumers in order to build up a domestic reserve. Current reserves are about a five-month supply.

#### NPA Hears Industry on How To Lick Benzene Squeeze

The United States must find new sources of benzene, producers and consumers of this chemical have told National Production Authority officials. Demand in 1951 is estimated by NPA at 220 million gallons. Supplies, including imports, are estimated at 207 million gallons.

Benzene demand has gone up 40 percent in the past four years. By 1955, requirements are expected to be double current production.

Supply and demand prospects for the next five to 10 years will be studied by a task force to see how need could be met through building plants for production of benzene from petro-

The producers and consumers group urged the government to expedite agreements under which the U. S. can get the substantial amounts of benzene that European brokers are reportedly holding for higher prices.

#### Du Pont Builds Cyanide Unit at Tennessee Site

A \$7.5 million sodium cyanide plant is being constructed by E. I. du Pont de Nemours & Co., Inc., about 10 miles north of Memphis, Tenn. When Du Pont's Electrochemicals Department starts operating the plant in January 1952, about 200 persons will be cmployed. Other units to make related chemicals will be built on the 225-acre site in the future.

Of the modern, open-air type of construction, the plant will conform to the latest advances in chemical process design. Most equipment will operate in the open, with control facilities and offices housed in brick, concrete and steel buildings.

Sodium evanide will be manufactured as a white crystal cast into tiny eggs. A basic chemical, it is widely used in metal hardening and electroplating. Principal raw material for sodium evanide production is natural gas, and several million cubic feet a day will be used by the new plant.

Over 3,000 gpm. of water will also be required. It will be obtained from drilled wells. After initial use in the cooling towers, 90 percent of the water will be re-used in the manufacturing process, lessening the drawdown on the local water table. Complete waste control is planned so there will be neither water nor air pollution.

James J. McIntyre, who has been transferred to Memphis as manager of the new plant, has been assistant manager of Du Pont's Niagara Falls, N. Y., plant, where sodium cyanide has been made for years. During World War II, McIntyre was assistant plant manager and production manager of the Chickasaw Ordnance Works, operated by Du Pont at Millington, Tenn., only a few mil. from the site of the new cyanide plant.

#### Carbide at Texas City Adds Butadiene Refining Stills

Crude butadiene produced at the Texas City, Tex., plant of Carbide & Carbon Chemicals Division of the Union Carbide & Carbon Corp. will be refined there when a \$750,000 expansion is completed before the end of this year. Hitherto the crude butadiene has been shipped to another Carbide plant for refining.

Four stills will be installed to re-

Four stills will be installed to refine the crude stock. The new construction plans also include the installation of a new boiler. It will be a gas-fired steam generator.

#### Texas Plant to Produce Chemical Fertilizers

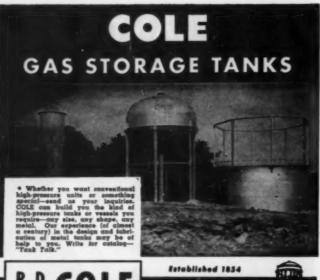
A new chemical fertilizer plant will be built by International Minerals & Chemical Corp. at Fort Worth, Tex., where ground has already been broken. When completed, the plant will have a capacity of 40,000 tons of plant food annually. In addition to superphosphate, it will produce mixed fertilizers. Land, buildings and equipment represent an investment of \$500,000. Completion is slated for June 15 this year.

The new International plant will have the latest materials handling systems. An overhead conveyor system will carry superphosphate from the plant into the main mixing building. Manufacturing, bagging and storing procedures are all planned for highest efficiency and minimum delay. A canopy over one of the loading docks will make it possible to load and cover plant food despite weather conditions. The plant is designed for future expansion.

On the north side of Fort Worth, the plant site takes up 30 acres. It is adjacent to the plant of Consolidated Chemical Industries, Inc., from which it will get sulphuric acid for use in making superphosphate.

(Continued)





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Falls Industries, Inc.

| News, cont. . .

International, with headquarters in Chicago, Ill., has plants and offices in 20 states. In addition to manufacturing mixed fertilizers and superphosphate, it is the largest producer of phosphate, ranks third in U. S. production of potash, is a major chemical firm, and is the world's largest producer of monosodium glutamate.

#### U. S. Seeks Ways to Get More Manganese Out of Poor Ores

Can the U. S. squeeze more manganese and manganese dioxide out of submarginal ore deposits within its borders? To find out, two new experimental projects are being undertaken at widely separated points in the West. Both are governmentsponsored.

At Boulder City, Nev., the Bureau of Mines is constructing a \$600,000 pilot plant to upgrade ores from the Artillery Peak area of Mohave County, from which some ore was taken during World War I. The workers at the pilot plant will seek an improved method of concentrating the ore to a minimum content of 40 percent man-

In the Pacific Northwest, Bonneville Power Administration has authorized the Mining Experiment Station of the Division of Industrial Research, State College of Washington, to work out an improved method of producing electrolytic manganese dioxide from ores in the Northwest. The investigation will be two-pronged, seeking: (1) production of a concentrate from the ores; and (2) electrolytic conversion of the concentrate into a dioxide for the manufacture of dry batteries. The Bonneville contract calls for a report on the work by next July.

#### Du Pont to Make Fiber V In New North Carolina Unit

Fiber V, made from terephthalic acid and ethylene glycol, will be produced in the new synthetic fiber plant that E. I. du Pont de Nemours & Co., Inc., is building near Kinston, N. C. The 635-acre plant site is on the Neuse River.

When Du Pont first acquired the site last September, it planned to build a fourth nylon yarn plant there. But now there's been a switch in plans. It's been decided to put Fiber V into commercial production as soon as

Meantime, nylon yarn capacity will be increased through technological improvements and expansion of existing

(Continued)

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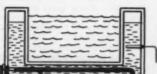


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News, cont. . .

plants at Seaford, Del., Martinsville, Va., and Chattanooga, Tenn. And Du Pont may license Chemstrand Corp. to produce nylon; if it does, output of nylon may be boosted by 50 percent within two years.

Construction of the Neuse River

Construction of the Neuse River plant will get under way this year. The size of the plant and its capacity have not been disclosed. Du Pont now makes both continuous filament yarn and staple of Fiber V in an experimental operation at Seaford.

#### Shell Expands Output of Ammonia on Pacific Coast

Shell Chemical Corp. will expand its synthetic ammonia plant at Shell Point, near Pittsburg, Calif. The added capacity will be operating this

Output of synthetic ammonia at the Shell Point plant has been increased four times during the 20 years of operation. When the new expansion is completed this spring, an increase of over 300 percent will have been chalked up during the past decade.

The increase was called for to meet growing demands for ammonia on the Pacific Coast by agriculture and industry.

#### Cat Polymerizer Added to Refinery on West Coast

General Petroleum Corp. has added a new catalytic polymerization unit to its Torrance, Calif., refinery. It will provide about 700 bbl. of high-grade blending stocks each day for use in the refinery's output of motor gasoline.

The new unit is fed with a mixture of two hydrocarbon gases, propane and propylene. These gases are byproducts of refinery cracking operations and are separated from both heavier and lighter material in the refinery's central gas processing plant.

In the reactors of the new unit the

In the reactors of the new unit the molecules of the propylene gas join up to make gasoline molecules, which are liquid at ordinary temperatures and pressures. Hence, they are more easily handled than gases and are more suitable for motor gasoline blending. A phosphoric acid catalyst aids and speeds up the process.

Propane molecules contained in the original mixture fed to the unit do not enter into the reaction. They remain in their original form and, after being purified, are sold as liquefied petroleum gas. The amount of propane produced varies with the particular mixtures being fed to the unit at any given time.

The new polymerization unit was built by the Lummus Co. and is now in operation. It represents an investment of over \$400,000.

#### Gas Machinery Co. Granted Basic Oil Gas Patent

Gas Machinery Co. of Cleveland, Ohio, has been granted a patent by the U. S. Patent Office relating to the production of oil gas using various types of process oil and with oil as a fuel for heating. The patent covers the basic process for the production of oil gas by modern methods.

The process differs essentially from the Pacific Coast oil gas process in the extent of cracking that takes place. The temperature and reaction time of the new process are such that the true oil gas produced has a higher heating value than Pacific Coast oil gas and differs from other prior processes. The present method has come to be known as the High Btu. Oil Gas Process.

Although the apparatus in some cases resembles equipment used for water gas production, the process is actually an entirely different one throughout. No solid fuel bed is employed nor does a water gas reaction occur to any extent during the cycle.

Processes coming within the scope of the patent have been installed and are being installed and licensed by Gas Machinery Co. The same basic steps are normally incorporated in the new Hall Process, which has lately received much attention. The latter process incorporates improvement through means of regeneration.

The Gas Machinery patent bears the number 2,522,922, and results from original development work by H. M. Blain of New Orleans. La. The process and equipment have been further improved, modified and expanded by Gas Machinery Co., which holds many other U. S. and foreign patents in this field. Patent applications on improvements and for other processes and equipment are still pending.

#### Wage Boost and Pension for Mathieson's Texas Workers

Some 400 union and non-union employees of Mathieson Chemical Corp.'s Houston, Tex., sulphur plant and its Pasadena, Tex., acid and fertilizer plants have been given an increase in basic wages based on a cost of living adjustment.

With union and company officials working in complete harmony, the Oil Workers International Union, Local 367, representing 18 employees at the acid plant, signed an agreement giv
(Continued)

"Ile a Difference!"

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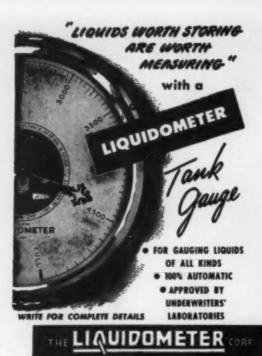
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\* At one time the French Chamber of Deputies was debating women's suffrage. When one liberal soul pointed out that there was very little difference, after all, between the sexes, a fellow deputy leapt to his feet and shouted with gusto, "Vive la difference!"

Two pressure gages may seem alike. But the difference between a Helicoid and any ordinary gage is unique. So much so that otherwise complacent engineers, who usually keep their feet on the ground, have been known to jump with ecstasy and exclaim, "Vive la difference!"





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strength and absolutely smooth inside walls. For the right answer to your critical process or power piping problem, write us or send your prints for an estimate.



W. S. MITCHELL & CO., DR. 2048 ELECTRIC STREET, PRILABELPHIA 48, PA.

News, cont. . .

ing the union total benefits and a wage increase in excess of 18 c. an hr.

The agreement calls for a classification adjustment of almost 10 c. an hr. It also contains provisions for shift differential pay and guaranteed holiday pay.

The union also signed a non-contributory pension plan in which the company makes all payments into the pension fund for employees earning up to \$3,600 a year. At retirement it provides a minimum of \$120 and a maximum of \$150 a month.

Essentially the same benefits have been given to members of the sulphur and fertilizer plants. These non-union employees have been given an average 5 c. an hr. increase in basic wages.

Both union and non-union employees will be given a cost of living adjustment every three months, beginning January 1, of 1 c. for every point rise in Houston's cost of living index.

Disability benefits ranging from a minimum of \$50 and \$98 a month at 50 years of age and 15 years of service are also included in the agreement.

#### Nopeo to Make Fatty Acid Derivatives in California

Palmitates and stearates, together with a line of chemical specialties derived from fats and oils, will be produced by Nopco Chemical Co. in two of its Richmond, Calif., plants starting next spring.

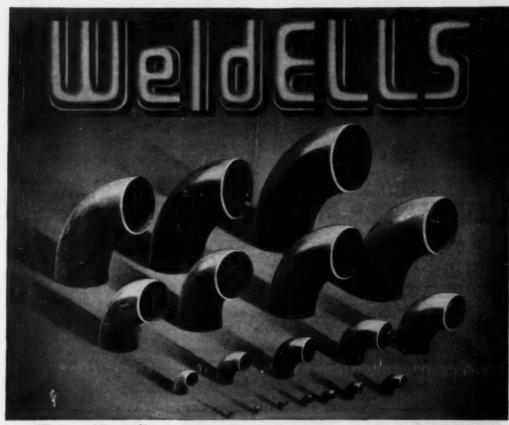
ing next spring.

One of the Richmond plants is being converted by Metasap Chemical Co., a wholly owned subsidiary of Nopco, to turn out stearates and palmitates of aluminum, zinc (both commercial and cosmetic grades), calcium, barium, lead and magnesium. Such products are used in the manufacture of greases, plastics, rubber, ceramics, textiles and other products. This plant formerly manufactured pharmaceuticals.

The other Richmond plant, in which Nopco formerly produced vitamin oil products, is being revamped to make such products as sulphonated oils, fatty esters, fatty amides and glycerides. These are used in pulp and paper, defoaming agents, detergents, polish bases and textiles.

#### Newcomer to Carlsbad Sinks First Shaft to Get Potash

Another producer is starting operations in the Carlsbad, N. M., potash field. Southwest Potash Co., a subsidiary of American Metal Co., Ltd., has let a contract to Winston Bros. Con-(Continued)



# Family Group ... proud of its size ... and traditions

Large group though it is, you see here only one branch of the world's largest family of fittings for pipe welding.

It is simply the stock sizes of long-radius WeldELLS in a single weight and material — merely a small fraction of the enormous line that includes more types of fittings, in more materials, more weights and more sizes than any other line.

Important though the breadth of the WeldELL line is to every man who designs or erects piping, still more important is the significant fact that the WeldELL family grew to this size because nothing less could meet the demand for fittings of WeldELL quality and uniformity to satisfy every conceivable piping condition.

Yes, there is a Taylor Forge Fitting for every purpose. From the smallest to the largest, every fitting in the WeldELL line shares the principle of sound engineering design and job-speeding utility that Taylor Forge has consistently applied for half a century.

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| Send Bullstin 473 covering Taylor Spiral Pipe and related fittings.

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Largest Compilation of Engineering Data.

Lists 200 Styles Furnished Without Die Cost.

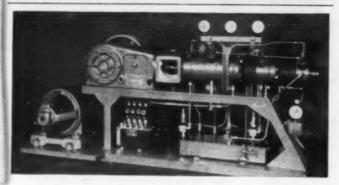
This standard reference contains complete specification information for over 200 standard styles of bubble caps and risors. Also drawings for use in determining methods of tray assembly. All styles list-

ed in Bulletin 21 are furnished promptly, without die cost, and in any alloy to meet your coking or corrosion problems. Special caps gladly designed; write as to your needs.

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## NORWALK COMPANY, INC.

SOUTH NORWALK, CONNECTICUT

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News, cont. . .

struction Co. of Minneapolis, Minn., to sink Southwest Potash's first shaft in the Carlsbad area.

An estimated \$10 million will be required, exclusive of working capital, to pay for the new Carlsbad venture. American Metal has access to as much as \$15 million for the operation and for other purposes.

If materials and labor shortages do not develop, production is expected to begin late in 1952. Estimated initial annual capacity: 185,000 tons.

#### Chemical Engineers Club of Washington Joins AIChE

The Chemical Engineers Club of Washington, D. C., has announced its affiliation with the American Institute of Chemical Engineers. The club thus becomes the National Capital Section of the AlChE.

Originally organized as a local club, the Washington organization has attracted wide interest in its annual symposiums. Last year Senator Clinton D. Anderson led a three-man panel that discussed ways of alleviating world-wide hunger. Man's battle against insects and other pests is scheduled to be the topic for this year's discussion.

George Armistead, Jr., a Washington consulting engineer, is president. Other officers are Randall D. Sheeline, U. S. Navy; William D. Kavanaugh, American Cyanamid Co.; and Herbert W. Yeagley, Monsanto Chemical Co.

#### Chlorine Pickup by Fabrics Treated With Resins Probed

In a 6,000-word research report buttressed by 10 tables of test data, A. C. Nuessle and J. J. Bernard of the Textile Applications Research Laboratory of the Rohm & Haas Co., Philadelphia, Pa., shed new light on the subject of chlorine pickup by fabrics containing nitrogenous resins when subjected to hypochlorite bleaching baths. The study relates principally to rayon fabrics treated with ureaformaldehyde and melamine-formaldehyde resins—and probes the effects of chlorine pickup on both yellowing during chlorination and loss of tensile strength on subsequent ironing.

Three factors were shown to have an influence on the quantity of chlorine retained: (1) concentration of hypochlorite bath, (2) bath ratio, (3) type of resin treatment. Five other factors were shown to be of minor importance. Three factors were shown to influence tensile loss on ironing subsequent to chlorination: (1) temperature of ironing, (2) concentration

of retained chlorine, and (3) type of resin treatment.

The melamine-treated fabrics were shown to be most subject to yellowing: the urea-treated most subject to tensile loss. A modified urea showed no yellowing, and negligible charring and tensile loss. Another urea tested lost much of its retained chlorine when rinsed at 160 Deg. F.

It is believed that, through this study, both launderers and finishers will find clues to the solution of their problems in connection with the bleaching of fabrics which are resin treated for crease recovery, shrinkage resistance and increased wet strength.

#### Phosphorus Furnace Will Tap **Rock Deposits of Montana**

Victor Chemical Works has authorized the construction of an electric furnace plant at Silver Bow, near Butte, Mont. Work will get under way immediately. The plant will manufacture elemental phosphorus from phosphate rock drawn from nearby deposits. The location fixed for the plant, and the selection of the mines, are the result of an investigation carried on over a long time by Victor chemists and engineers.

The plant reportedly will cost about \$5 million. Capacity of the furnace is expected to be somewhere in the neighborhood of 10,000 tons of

phosphorus a year.

Victor Chemical Works now operates phosphorus plants in Tennessee and Florida, and four other plants in Illinois, Tennessee, Pennsylvania and California in which phosphorus is processed into various types of phosphates and phosphorus compounds.

#### Refinery in Texas Purchased By Two Oklahoma Companies

Mid-States Pipe & Supply Co. and Rogers & Wright, Inc., both of Tulsa, Okla., have purchased the Texas Co. refinery in West Dallas, Tex., according to H. A. Horowitz, Mid-States president.

The plant, with a capacity of 21,-000 bbl. daily, suspended operation in October, 1949. It covers about 450 acres, including operating units, processing equipment, tank farm, pump houses and warehouses.

The company is negotiating for the lease of oil storage tanks on the large farm, which has a capacity of 1,500,-

000 ыл.

Whopping alkyd unit, one of the world's largest single-kettle installations, is being designed and constructed for the Jones-Dabney Divi-(Continued)



#### SIMPLE DESIGN FOR ACCESSIBILITY

Inlet and exhaust connections are located in lower half of casing which is horizontally split to allow easy access to all internal parts. Rotating unit including bearings and governor head may be removed without disturbing alignment of the unit.

#### . RUGGED CONSTRUCTION FOR RELIABILITY

Whiton rotors are made from a solid steel forging with semicircular buckets milled in the rim to give strength where it is needed. End thrust is minimized because the path of the steam is always at right angles to the shaft.

#### . SAFETY DEVICES FOR TROUBLE-FREE OPERATION

Standard equipment includes Constant Speed Governor with V-Ported Governor Valve . . . Emergency Governor with Independent Valve . . . Steel Plate Steam Strainer . . . Two oil rings per bearing supplemented by water cooling . . . Sentinel Type Casing Relief Valve . . . Additional accessories available as required.

#### THOUSANDS OF SATISFACTORY INSTALLATIONS SINCE 1911

Write for complete information WHITON

MACHINE COMPANY NEW LONDON CONN

News, cont. . .

sion of Devoe & Raynolds Co. at Louisville, Ky., by the Chemical Plants Division of Blaw-Knox Construction Co. Processing equipment is to be constructed of stainless steel and heated and cooled by Dowtherm. Blaw-Knox built the first Dowtherm heated and cooled resin production unit in the country for Devoe & Raynolds in 1937.

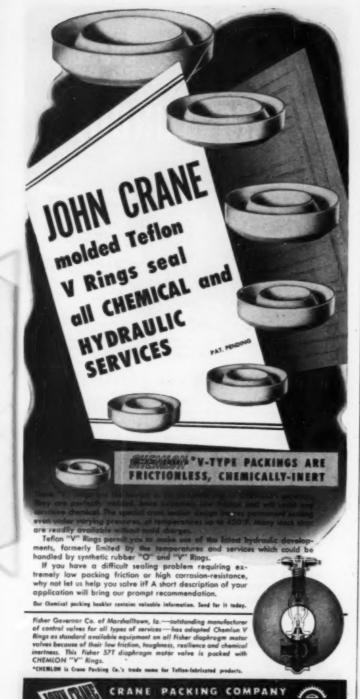
Pentaerythritol production is being stepped up by Heyden Chemical Co. New units for its manufacture, together with a new power plant, now being built at Garfield, N. J., at a cost of \$1,175,000, are slated for completion during the last quarter of 1951. Last year, the U. S. produced close to 25 million pounds of technical pentaerythritol. Big civilian use is in alkyds, where it helps to eke out scarce and costly glycerine supplies. And the military will need plenty of it for pentaerythritol tetranitrate or PETN, which is a powerful detonating and priming high explosive.

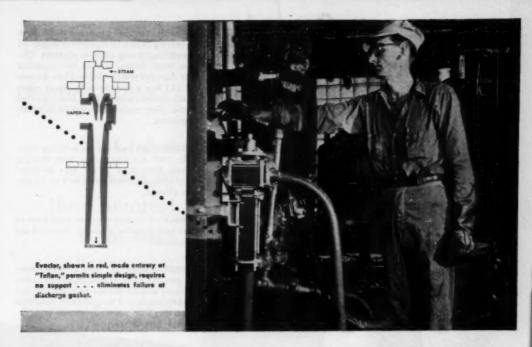
Solvent extraction unit will replace the 11-year old expeller plant at the Grand River, Ohio, soybean processing plant of A. E. Staley Manufacturing Co. The new plant, a part of the company's over-all modernization program, should be completed in time for the 1951 fall harvest, and will have a daily processing capacity of 10,000 bu.

Bleached pulp production will be expanded by the Brunswick Pulp & Paper Co., Brunswick, Ga., by a \$5 million improvement program that will take over a year to complete. Daily wood pulp capacity will be increased from 290 to 400 tons.

Liquid resin plant of Catalin Corp. of America at Calumet City, Ill., will be enlarged by the Chemical Plants Division of Blaw-Knox Co., which only recently completed the original plant. Two additional processing kettles, together with auxiliary equipment, will be installed. The expansion will be completed this fall.

Pharmaceutical plant in Los Angeles for Riker Laboratories, Inc., wholly owned subsidiary of Rexall Drug Co., will be designed and constructed by Arthur D. Little, Inc., which cooperated with Riker in the pilot-plant work. The new plant will produce Veriloid, a purified and standardized extract derived from Veratrum viride, which is used in treating high blood pressure. The plant is just getting into operation. —End





#### JET EVACTOR MADE OF DU PONT "TEFLON"\* LASTS LONGER ...

# saves over \$1600 in first 18 months

## Tough and corrosion-resistant, it has already served up to six times longer than former units

In the words of the engineer in charge of the unit: "This jet is one of the most satisfactory pieces of equipment in corrosive service ever used in this plant. Its use has resulted in gross savings of over \$1600 for replacement parts alone."

In Service over eighteen months, handling sulfuric acid and steam at 360° F., 150 lb./sq. in., this jet evactor is still in first-class operating condition. Evactors made of conventional material had an average life of only three to six months.

Use of "Teflon" tetrafluoroethylene resin has eliminated corrosion, and has reduced wear on the nozzle and diffuser to a negligible amount. Its excellent mechanical properties permit easy gasketing at the discharge joint. That's where former jets failed most frequently.

The evactor made with "Teflon" is of much simpler design than former units, which required support by encasement in metal castings. No support is necessary when "Teflon" is used. This quality coupled with long-lasting, trouble-free service means a big saving in costs.

Demand for "Teflon" currently exceeds supply. However, we suggest you investigate the versatile properties of "Teflon" for future product improvement. Experimental quantities are available. "Teflon" is supplied by Du Pont as molding powder, tape, and water dispersions. For additional

information on this and other Du Pont plastics, and for names of molders or fabricators who can supply finished parts of "Teflon," write:

E. I. du Pont de Nemours & Co. (inc.) Polychemicals Dept., Sales Offices: 350 Fifth Avenue, New York 1, N. Y. 7 S. Dearborn St., Chicago 3, III. 845 E. 60 St., Los Angeles 1, Calif.

> Jet Evactor manufactured by Schutte & Koerling Co., Phila., Pa.

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LVE TOP-Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assem-

bly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate

ADJUSTING SCREW-Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

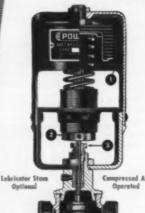
LOWRITE

BONNET ASSEMBLY-Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES - Sizes 1/2" thru 8"- For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

# **BETTER Valve Tops**

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VALVE SIZES-1/2" thru 2"

bodies, screwed ends. Rugged construction to withed piping strains.

POWERS Metaflow Valves are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

- 1. HOUSING—High strength aluminum allay. Hydraulically formed long life bross bellows provides smooth and powerful strake.
- 2. ADJUSTING SCREW—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.
- 3. BONNET ASSEMBLY-Polished stainless steel stem in preformed lubricated metallic packing insures long life and law hysteresis.

TRIM-Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Frean, ail, gasoline, non-corrosive gases, hat or cold water and low pressure steam. Phone or Write Nearest Office for Prices

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OVER 58 YEARS OF PNEUMATIC TEMPERATURE CONTROL

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#### A Global View of the Chemical Industries

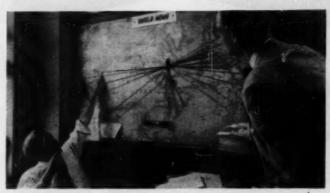
. . . Manufacturing center for fissionable material in remote east Russia? Italy—the answer to dwindling sulphur supplies? What about Manchuria's chemical industry, chemical bottlenecks threatening North Atlantic Pact countries' rearmament program, U.S.-Cuba-France triangle over alcohol? . . .

These days activity in the CPI is a slobal affair. Through Chemical Engineering's pages, you have at your service a news-gathering machine that detects and follows up developments at their first stirring. Let's take a look at the people and places that are the machine's vital parts.

Mainspring is the New York bureau here on 42nd St. Outgoing assignments and incoming releases funnel through the hands of Russ Anderson, bureau head. He's a former daily newspaperman and press association correspondent. From 1938 until Pearl Harbor he was stationed in Europe for INS. He returned from Pacific Naval service with the rank of lieutenant-commander in time to help set up our news-gathering network in 1945. A graduate of the University of Michigan, he studied at Northwest ern, Pittsburgh, London University.

A glance at the world map at An derson's fingertips (see cut) points up the breadth of our coverage. Releases pour in from (1) full-scale McGraw-Hill World News bureaus in London, Paris, Frankfurt, Tokyo, Rio de Janeiro, Mexico City, Bombay, Mel bourne; (2) 60 part-time and retainer correspondents spotted strategically around the globe; (3) Reuters' 40 overseas offices and 73 correspondents (through contractual arrangement).

Manning World News foreign bureaus are seasoned correspondents with engineering-economic backgrounds. They're experts at ferreting out indus-



Gordon Anderson, head of World News central bureau in New York.



F. R. Brewster-London



J. K. Van Denburg-Rio

trial and scientific information. Finding staffers with these requirements, in addition to being bilingual in the country of their assignment, is always a slow job. Once found, they get a special three-month training course, just for good measure. Their functions: gathering material on their own initiative; querying on potential articles; handling assignments from the New York bureau. They round up all source material for processing and writing in New York. Here's how they line up.

London. Top man in London is Frederick R. Brewster. This department owes its September story on Cabot's British carbon black unit to him. In fact, he has a finger in any stories stemming from the English countryside. His first literary venture was "The Analyst," a column of economic and political comment in the Oberlin College newspaper. Degree in economics was earned in 1937 with a

thesis on the devaluation of the Belgian and French monetary systems. After graduation he won a work-study scholarship offered by the publishers of three industrial and trade magazines. He did field research for Railway Age, American Builder and Marine Engineering. When he was relieved of his wartime command of a sub-chaser in 1946, he came to New York. He may have been thinking of taking steps to fulfill an ambition he still harbors-to produce a Broadway show, even if it flops. But he stopped by at McGraw-Hill to discuss some electronic developments. He proved so knowing in things technical that we propositioned him. End result: his present post.

Rio de Janeiro. Heading the Rio office is Joseph K. Van Denburg, Jr. Lanky . . . quick to smile . . . product of Dartmouth and Columbia . . . he started out as a reporter on the Miami Herald. He served as editor of the (Continued)

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Stainless Steel SAN-I-TANK — standard or
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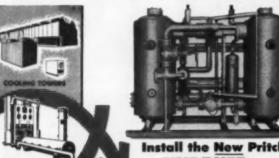
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FOREIGN NEWS, cont. . .

Ft. Lauderdale (Fla.) News, spent three years as assistant city editor of the Washington Evening Star and was on the editorial staff of Aviation News when World News lured him over. Until last spring he was stationed in the Bombay office. Despite the di-versified location of Indian industry, lack of press relations on the part of business, he turned in a three-year job of the top-flight coverage. One of the last things he did was to set up the machinery that resulted in our June feature, "Unique Fertilizer Plant Claims Many Firsts," written by the general factory superintendent, Fertilizers & Chemicals, Travancore Ltd. Van Denburg, himself, wrote an article on the engineering that went into the plant's construction for our August 1947 issue.

Tokyo. Alpheus (Bill) Jessup holds down the Far Eastern spot. He fed us our recent picture sequences on the drastic effects of war on Korean chemical plants. Right now he's trying to dig out data on chemical plants in



A. Jessup

Manchuria. An assignment as an American artillery observer with the British 36th Division in Burma was his introduction to the Far East. Except for brief trips back to the U. S., he has been there ever since. For a time, he headed the China edition of Stars and Stripes. He joined World News in 1946, spent 1947 in Shang-hai, then shifted to Tokyo. Indicative of his reportorial status is a recent request from a State Dept. representative in Tokyo that a Jessup story on conditions in Japan be forwarded to the attention of the Secretary of State. Jessup was a member of the staff of American Machinist before entering the Army. He's a graduate of Lehigh.

Frankfurt. John C. Christie took over the German post in 1946. Educated at Boston University, University of Kentucky and Northcastern University Law School, he joined the Army as an ETO staff member. He



J. C. Christie

staff member. He specialized in preparing special pre-(Continued)

GAS EQUIPMENT

**EQUIPMENT** 

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DAVISON has the experience and knowledge to chemically control silica gel production for precise uniformity of structure. Such silica gel characteristics as pore size, density and internal surface area are altered to assure maximum benefits in your application.

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Properties: HIGH PURITY @ CHEMICALLY AND PHYSICALLY INERT @ CONTROLLED ADSORPTIVE CAPACITY @ CONTROLLED DENSITY @ FREE FLOWING @ SURFACE AREAS UP TO 1000 SQUARE METERS PER GRAM Typical Uses: Anti-Caking agent in dyes, Chemicals, Foods, Pharmaceuticals @ Decolorization of Organic Compounds @ Pigment extenders and Flatting agents @ Dehydrating agent in Aluminum Paint @ Insecticide Diluents @ Increasing Porosity of Medicinal Tablets @ Selective Separation of Pharmaceuticals and hydrocarbons

TYPICAL ANALYSIS ON DRY BASIS 99.71% PURE SiO<sub>2</sub>: Where cost of materials is a primary factor and constituent compounds will not affect your process, Davison silica gel can be supplied in less pure form. The material is also available in greater degrees of purity for extremely sensitive processes.

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FOREIGN NEWS, cont. . .

invasion reports on Germany-followed by an on-the-spot year in the Reich itself. With McGraw-Hill, he served in London for a time before returning to Germany. We featured in October his report on the first ACHEMA since 1937 and in November his "German Chemicals Are Coming Back." Among his other major contributions were a couple of pieces in 1948 on I. G. Farben, its disintegration and its future.





B. France

J. Wilhelm

Code words around here for Paris, Mexico City, Melbourne and Bombay are France, Wilhelm, Leopold and Creswell - respectively. Boyd France, logically enough, is our chief envoy in Paris. Educated



H. Leopold

at the University of Mexico and Rollins College, he's done French radio commentating, served on the editorial staff of the Paris Post and in the Paris bureau of Reuters. John Wilhelm, Mexico City, came to World News after three years in Europe for the Chicago Sun. While overseas he was Pulitzer Prize nominee for his series on Britain's economic position. Herbert Leopold who's been keeping us posted on the news from down under is set for a shift to Manila some time this year. Philip Creswell, filling the spot vacated last spring by Joe Van Denburg, has been ably holding down

# the fort in Bombay.

#### Reported This Month . . . GERMANY

Five-year plan just begun in East Germany aims at almost doubling chemical production. Plans are on the fire for widespread building and rebuilding of plants. New methods are under development for producing heat-resisting varnishes, lubricating oils, chemicals from chlorides. They've solved their sulphuric

#### TURN DUST INTO DOLLARS with MULTI-WASH

Central Dewatering System

Consider the salvage value of waste chemical dust. Many processors are reclaiming such dust as a valuable by-product for extra dollar volumewith Multi-Wash dust collectors.

Application of a Multi-Wash central dewatering system to your process, may very easily pay for itself and return extra profits.

Your inquiry will receive expert attention-call the local Schneible angineer or write direct.

#### CLAUDE B. SCHNEIBLE COMPANY P. O. Box 502, Rossavelt Annex, Datroit 32, Michia





.

acid shortage by using gypsum instead of rare pyrites as raw material. Three furnaces with a filling capacity of 24 tons each were built in 1949 in a Salzwedel sulphuric acid plant. Organic chemical production is hampered by lack of borax, shellac, arabic gum, urea, hard coal.

Crude oil production was 100,350 tons in October in West Germany. For the first time since the end of the war the 100,000-ton mark has been surpassed. Output of refineries was estimated at 4,226,000 tons for the period from July 1950 to June 1951 as compared with 2,198,000 tons the previous year.

Fertilizer production in West Germany is being seriously hampered by the coal shortage and may have to be considerably reduced. It is feared that planned increase in domestic use of fertilizers will also be affected.

Oil processing contract has been concluded between Ruhrchemie AG at Oberhausen-Holten and Omnipetrol Oil Processing Co. at Karlsruhe. It provides for transformation of war-damaged Fischer-Tropsch installations of Ruhrchemie to refinery use. New refinery is also to be built at Oberhausen. Crude oil will come from the Middle East; total processing capacity will be 200,000 tons.

#### CANADA

Three-year expansion program is planned by Powell River Pulp and Paper Co. Cost will be \$11 million. Newsprint output of the Powell River, B. C., mill, now producing 1,000 tons a day, will increase by 40,000 tons a year.

\$8 million oil refinery in Edmonton is scheduled to begin operations next June for McColl-Frontenac Oil Co. Complete with a catalytic cracking unit, plant will have an initial capacity of 6,000 bbl. daily.

Mechanical rubber goods plant to cost \$5 million is being constructed at Sarnia, Ont., for General Tire & Rubber Co. Proximity to the Canadian government's plant manufacturing synthetic rubber supplies prompted choice of locale for the company's first Canadian manufacturing unit.

Revival of tungsten production is under consideration by the government. Canada turned out tungsten (Continued)

# Rubber-base (Parlon) Paints

# GIVE EXTRA PROTECTION

## against Acids and Alkalies

Where other paints fail because of acid or alkaline plant conditions, it may pay you to specify corrosion-resistant, rubber-base paints. For concrete and most metal surfaces, paints properly formulated with "Parlon" (Hercules Chlorinated Rubber) are unsurpassed for resistance to common destroyers of maintenance paints. Besides alkali and chemical resistance, these paints have outstanding wear resistance, dry fast, and are easy to apply.

More than 500 paint manufacturers now offer one or more rubber-base paints made with chlorinated rubber. These maintenance paints may cost a little more per gallon, but usually cost far less per square foot per year. We'll be glad to supply the names of several firms in your locality who can advise you.

WITHSTAND
CHEMICAL ATTACK
AND ABRASION
OUTSIDE
THE PAINT FILM

WITHSTAND
CHEMICAL ATTACK
AND LIFTING
BENEATH
THE PAINT FILM

HERCULES POWDER COMPANY 952 Market St., Wilmington, Del.

Send further details on "Parlon" paints and names of suppliers.

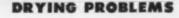
Name

Company.

Address

CR51-1

#### TIPS ON SOLVING



# IN PROCESS PLANNING SHOULD YOU CONSIDER DRYING EQUIPMENT?

The time to seriously consider the selection of drying equipment is the moment you realize that your process is going to involve drying. Long experience in working with company after company has proven that drying equipment is one of the most important links in the processing chain . . . and that the most economical designs result from early consideration of drying as an integrated link in an over-all process.

Dryer design is dependent upon a number of factors...
the capacity desired and physical characteristics of the product
being the two chief considerations. In studying any given problem,
Proctor engineers may recommend that to obtain a desired
capacity, the product be delivered to the dryer in a certain
state... and this may govern the type of preliminary equipment
that is required. Then too, the characteristics of the dried
material may affect the type of subsequent equipment you will
need. That is why it is advisable to consider the problem—as a
whole and early—rather than select your equipment piece by piece.

For an interesting booklet that explains how early consideration of your drying problem can guarantee the performance of drying equipment write for Bulletin #343. For more information of Proctor Drying



PROCTOR CONTINUOUS CONVEYOR SYSTEMS

PROCTOR & SCHWARTZ, INC - 711 TABOR ROAD - PHILADELPHIA 20 - PA -

FOREIGN NEWS, cont. . .

during the last war but since then supplies have been coming from the U.S., Bolivia and other South American countries. These sources are now felt to be undependable.

Anhydrous ammonia will be produced at Dow Chemical of Canada plant under construction in Sarnia, Ont. Cost: \$1 million; capacity: 15 tons per day. Hydrogen, to come from Dow's existing chlorine-caustic plant at Sarnia, will be combined with nitrogen from the air under high pressures. Facilities will be similar to those of Dow Chemical Co. at Midland, Mich., and Freeport, Tex.

De Nora mercury-type cells with a rated capacity of 30,000 amp. will be used in Marathon Paper Mills' chlorine plant to be erected at Marathon, Ont. With a capacity of 25 tons of chlorine a day, the plant will be the first sizeable one in the U. S. or Canada to use these cells. Designed by Monsanto, it will manufacture rayon-grade caustic soda, chlorine, electrolytic sodium sulphide, sodium hypochlorite and synthetic hydrochloric acid.

#### BRAZIL.

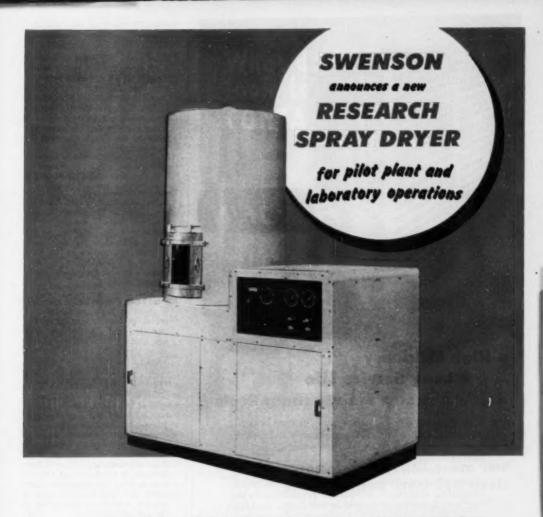
Trial runs have started at the government-owned petroleum refinery at Mataripe, Baia State. Full production at the rate of 2,500 bbl. a day is expected soon. Plant will manufacture 40 percent gasoline, 33 percent fuel oil, 11.5 percent kerosene and 2 percent diesel oil.

Domestic rubber supplies are, for the first time, insufficient to meet requirements of rubber products manufacturers. Import licenses are being granted for shipments from overseas suppliers.

Soda ash and caustic soda manufacture on a large scale is on the point of becoming reality in Brazil. Plant is to be located near extensive salt pans near Porto do Forno, on Cabo Frio, the cape east of Rio de Janeiro. It would have a soda ash capacity of 100,000 m. tons, of which 66,000 m. tons would go into production of 45,000 m. tons of caustic soda. In the first half of 1950, Brazil had to import 26,112 m. tons soda ash, 33,890 m. tons caustic soda.

Behind the project is Cia. Nacional de Alkalis which combines both government and private capital. Plans (in the making for over

(Continued)



This new unit provides instant drying at low temperatures with close control of the moisture content of the finished product. It is recommended for all applications requiring small drying capacities.

The Swenson Research Spray Dryer can be used as a research tool for the development of new products and new processing methods of old products. It can be used for the commercial production of high-value, low-volume pharmaceutical and fine chemical products where present processing methods result in poor quality control and costly losses. Completely described in Bulletin D-106—send for a copy.



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For the most practical solution to your heatexchange problem, ASK THE AEROFIN MAN.



Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

FOREIGN NEWS, cont. . .

three years) will move forward as soon as expected approval comes through on a government appropriation that will bring total working capital to \$15 million. Fraser-Brace of New York provided the original consultation and obtained rights to manufacture under processes patented by the Yungli Chemical Industries Ltd.

#### **NETHERLANDS**

Royal Dutch-Shell expects to raise its output of lubricating oils. A subsidiary, Curacao Petroleum Industry Co., will build a number of installations to be completed by the end of 1953. A similar installation is under construction in the Shell refinery at Punta Cardon in Venezuela, scheduled for completion by the end of 1951.

Rubber Latex Powder Co., Amsterdam is about to begin manufacture of rubber powder for use in rubber asphaltic road construction. The new firm will use a spraying process as in production of milk powder. Thus far the powder has been produced only in Indonesia, Bandoeng and Singapore by a process of chemical precipitation.

#### ITALY

European sulphur shortage resulting from cuts in American exports may be somewhat alleviated by Italy. Assuming that the U. S. will have difficulty in supplying over 400,000 tons in 1951, the government estimates that Italy would be able to put raw sulphur on the market at the rate of: 200,000 tons, 1950-51; 200,000 tons, 1952-53; 450,000 tons 1953-54. Even at that, a deficit of 400,000 tons is estimated for 1950-51. To bring down too-high prices, 4 billion lire has been allocated for modernization of mining in southern Italy and Sicily.

Magnesite from sea water operations will be carried on at a plant to be built on the Tuscan coast in the vicinity of Apuania. Italian Electro-Chemical Co. estimates cost at \$1.2 million, capacity at 12,000 tons (90 percent of Italy's total needs).

Important hydrocarbon layers (18) have been discovered in the western valley of the Po and only a sixth of the area, covering 30,000 sq. km., has been explored. Caviago, Ripalta and Sangiorgio Piacentino wells supply methane while wells at Cortemaggiore supply both methane and oil. It is estimated that these four sources are capable of a daily output of gas and liquid fuel equivalent to 6,000 tons of coal for 20 years to come—that is about one quarter of the coal Italy now has to import.

#### **SWEDEN**

Alarmed at soaring prices, labor government has again put an export levy on pulp and paper. It is not an export tax, but a means of impounding excess profits—tentatively, until 1958. Repayment will then start at the rate of 20 percent a year.

Glass down plant, first in Europe, has been put into operation by Hoganas-Billesholms, best known in the U. S. as a powdered iron producer. It has taken the company five years of experimentation to reach the manufacturing stage.

#### RUSSIA

Bacteriological warfare and production of radioactive material are absorbing the Russians more than atomic bombs, according to reports reaching Sweden. Large scale production of radioactive matter, suitable for spreading by guided missiles or planes is said to be going on in inner Siberia and the Tadjit-Uzbekistan area. Bacteriological warfare experiments are being conducted at 40 different places. The inference is that attempts at bombmaking have not been very successful. A further report says that the only atom bombs Russians have been able to produce would have to be delivered by submarine.

#### **GREAT BRITAIN**

Coal shortage may be alleviated by producing ordinary household gas from heavy fuel oil instead of from coal at an economic price. Oil gas suitable for mixing with coal gas in any proportion has been produced experimentally and is now being studied in pilot plant quantities at the Central Laboratories of the Institution of Gas Engineers.

Gasoline and other oil products have begun to flow from a new plant at the Shell Haven, Essex, refinery at a rate of 1,450,000 tons a year. The full refinery, scheduled for completion by 1952 will have an output capacity of over 2 million tons a year.



# Handling, Packaging and Shipping R. W. Laker, Editorial Consultant

2

Drawn steel bilged barrels-light in weight; curved sides add strength.



Straight side, removable head drumrolling hoops absorb handling shocks.

PACKAGING NOTEBOOK-VIII

#### RETURNABLE METAL DRUMS

Heavy returnable metal drums are specially designed for each product that they carry—particularly to maintain quality of the compound without contamination. In each design full consideration has been given to the safety and convenience of the men who fill, handle, empty and clean them.

These metal drums are the work horses of the chemical industry. Where the going is hardest, these containers lead the way. Because of the great variations in the chemical and physical characteristics of the products carried in them and due to the differences in the services which these drums must perform, many different constructions are required. They are actually tailor made for each product. Steel containers may be galvanized, tinned, terne or lead coated. Interior linings such as high baked resins, natural and synthetic rubber, and bonded lead are used. Aluminum, stainless steel, nickel and magnesium may be used as well as steel as materials of fabrication.

They must be of extremely rugged construction to withstand constant exposure to the elements including the corrosive vapors encountered around chemical plants, to cope with the corrosive action of many of the compounds which they carry and to combat the extremely rough handling that they encounter. They are specially designed to protect those who handle

them from the hazards of the many dangerous products packed in these containers.

Returnable metal drums are fabricated in both bilged and straight sided types and each type is available in the full open head and tight head (bung opening) constructions. There are advantages claimed for both basic types. Bilge barrels are lighter in weight and the arched construction stiffens the sidewalls. This shape, having relatively small contact with the floor when on its side, can be easily rolled, turned and upended. On the other hand, the straight sided drums equipped with 1-bar rolling hoops, are easy to roll and can be upended readily because hoops extend from 1½ to 1½ in. beyond the shell. The rolling hoops absorb shocks and thus provide protection from handling abuses.

Although these drums are manufactured in sizes up to 110 gal., there is very little demand for containers having capacities over 55 gal. It has been found that the filled weights of the larger containers unless moved mechanically, are too heavy for safe and economical handling. To illustrate, a 110 gal. drum containing sulphuric acid has a gross weight of 1,880

The adoption of steel sheets rolled on continuous mills has greatly improved the quality of the steel used to fabricate these containers. This





Steel acid drnm, 3-piece construction—double-seamed heads, chime reinforcement.



Typical workhorses of the chemical process industries—these steel acid drums with 2-piece construction and 55-gal, capacity.

# Your **Union Multiwall Specialist**

Knows many ways to cut packaging costs

How LONG has it been since an expert analyzed your packaging methods?

Recent improvements in packaging methods and materials now make Union Multiwall Bags the preferred packaging for many different commodities . . . over 300 in all. They speed up packaging, cut labor and shipping costs, guard against contamination.

Even if you're now using multiwall bags, the Union Multiwall representative who calls on you can give you new ideas that may save you money. For he is backed by the specialized packaging knowledge of America's largest maker of paper bags-with its own forests, the largest completely integrated Kraft pulpto-bag plant in the world, and skilled engineers and designers.

Let him show you how Union resources and packaging experience can help you!









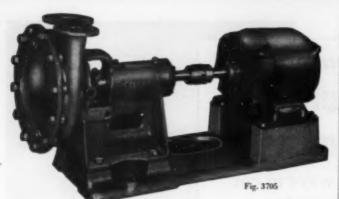


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# For Outstanding Service Handling Corrosive Liquids—

#### Goulds new stainless steel centrifugals

#### ADVANCED PUMP DESIGN-

The Goulds 3705 stainless line represents the last word in effective design. Fig. 3705 pumps will give you efficient, dependable, 24-hour service in handling corrosive liquids—at low cost.

#### CAPACITIES-

Goulds stainless steel centrifugals are made in 8 sizes with capacities to 750 G.P.M. and heads to 180 ft. depending upon capacity.

#### ADVANTAGES-

Exceptional efficiency (see Bulletin for performance curves) plus extreme simplicity make this an ideal pump for corrosive applications. High interchangeability of parts cuts stocking problem. Quick inspection or cleaning—simply remove casing cover without disturbing pipe connections.

Write for Bulletin 725.3 for complete details on this new stainless steel pump,



PACKAGING, cont. . .

steel has superior mechanical and welding characteristics and is relatively free from objectionable amounts of surface oxides or other defects.

Heads are usually double seamed to the cylinders but they can be welded. Heavy chime reinforcements are then rolled over the double seams as well as the welded chimes. During the last world war a new technique was developed for more effective application of these chime reinforcing bands. This improvement has greatly increased the strength of the chimes.

One manufacturer cold draws flange quality steel in hydraulic presses. The drawn seamless cups, after heat treating, are welded circumferentially. This provides containers with no chime seams. The chimes are usually protected with curled sleeves which are welded to the sidewalls of the drums. Both straight sided and bilged types are fabricated by this process.

Flanges for openings in tight head drums should be welded to the drums as it is essential that this joint be as strong as it is possible to make it in order to obtain the maximum service from these returnable containers. Proper steel must also be used in the flanges.

Rolling hoops provide ease in handling and they also protect the shell of the drum from many transportation abuses. The expanded or rolled in hoops have generally been replaced by I-bar type because of the greatly increased protection to the drum provided by this latter type. I bars are sometimes attached by expanding the drum shell on each side of the hoop. Another method is to weld retaining plates to the drum shell which extend over the flange of the I bar itself. The disadvantage of the first method is that the drum is difficult to drain completely due to these depressions. On the other hand the use of retaining plates to secure the I bars is not recommended unless perfect welding is assured. Tare weight is increased 14 lb. by 2-in. I bars and 17 lb. by 1-in. I bars.

Full open head drums are required for packing such products as pastes, heavy viscous liquids, and dry materials. This construction facilitates loading and emptying. Returnable containers used for transporting food products require perfect cleaning which is only obtainable in drums of the full open head type. Pigmented paints, lacquers, and enamels which require agitation before using are also packed in these drums. The containers are often equipped with agitators.

The open head construction is

manufactured in both straight sided and bilged types. Pressure is applied on a gasket between the cover and the top chime of the drum by means of reduction in the diameter of a locking ring. Either a bolt and nut or a lever can be used to accomplish this. Recently it has been found that an overlapping type of ring provided a tighter seal for the cover. Small openings (‡ in. or 2 in.) either mechanically inserted or welded are sometimes placed in heads or bottoms of full open head containers. These small openings placed in the bottom act as a vent and often reduce time required for emptying heavy pastes.

There are two types of bilge bar-

There are two types of bilge barrels on the market—one is a cold
drawn seamless drum and the other
has a but welded body seam with the
body. There are a variety of straight
sided full open head drums available.
They have conventionally welded body
seams with bottoms attached by double seaming, welding, or brazing.
Chime reinforcements are used to
cover and stiffen this joint. Either
swedged or I-bar rolling hoops are

used.

Use of returnable metal drums usually involves a substantial investment. This can be minimized by establishing proper maintenance and good storage conditions for empty containers. As soon as empty drums are received they should be inspected and repaired if necessary. They should be cleaned promptly and scraped and painted at frequent intervals. Gaskets should be replaced and bungs greased and made tight. They should then be stored under cover awaiting filling. It is usually just as important to minimize deterioration rates of returnable containers as it is for production equipment.

Cleaning practices vary. In some instances the use of steam, caustic soda, or other cleaning compounds will suffice. If not, it may be necessary to first loosen residues by using metal chains. Drums can be revolved in different positions depending on the type of drum cleaners chosen. Interiors of drums should be dried before openings are replaced.

It is often more difficult to remove dents particularly from tight head containers. Hydrostatic or air pressure is sometimes used for this purpose but it may be hazardous particularly the use of air pressure. Drum heads must be supported to prevent bulging and if air pressure is used, adequate barriers should completely surround the drum in the event of a failure.

Drums should be repaired only by workmen thoroughly experienced in (Continued)



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AND FITTINGS

#### for PERMANENT Liquids Handling Systems!

Reduce costly shutdowns with the acid and alkali resistant porcelain that keeps liquids handling systems in constant operation. An Illinois porcelain system will keep production high—will eliminate losses due to corrosion, electrolysis and mineral deposits which affect ordinary fluids handling materials.

All Illinois pipe, valves and fittings are produced under the highest standards of quality control. Dimensions are accurate, ends are ground true and smooth for gasket mounting, and flanges are jig-assembled. All necessary nuts and bolts are furnished.

Illinois porcelain has inherent corrosion-proof qualities. Its super-smooth, non-absorbent inside surfaces and strong fracture-resistant walls make it outstandingly successful as a chemicals handling medium. No rough or pitted inner walls.

We would be glad of the opportunity to help you solve your corrosion problems.

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WRITE FOR FREE CATALOG C-3



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PACKAGING, cont. . .

this work with full knowledge of the hazards involved. For instance, residues in acid drums should be neutralized and interiors properly cleaned before repairs are started. The Manufacturing Chemists' Association have a safety manual on this subject which should be used as standard practice. Old spuds can be cut out and replaced by welding in new ones. This can often increase the life of these containers by 30 to 40 percent. Broken rolling hoops can be welded and replaced or new I-bar hoops can be attached.

The choice between using returnable or single trip drums involves a detailed study of all costs as well as an evaluation of customer reaction to both types. Although the trend is towards single trip containers, there are instances where the use of returnable drums is either warranted because of reduced costs or is mandatory because of the hazardous characteristics of the product.

#### More ICC Regulation Changes for Your Files

On August 29 the ICC published amendments to their regulations. These changes became mandatory on November 27. Those amendments of special interest are summarized below. The order should be consulted for complete details.

SEC. 203(m)(4)(a), (m)(4)(b), (m)(4)(c), (m)(4)(d), (m)(4)(e) REFRIGERANT (ASES which are non-poisonous as the control of the

SEC. 363(q)(1) Note (8) TEST OF CHLORINE TANK CARS OTHER THAN ICC 1664. The emergency regulation which extended tests to three-year intervals has been cancelled. Tests must now be made every two years.

following categories when tested on laboratory animals:

ORAL TOXICITY. Those which produce death within 48 hr. in half or more than half of a group of 10 or more white laboratory rats weighing 200 to 300 g. at a single dose of 50 mg. or less per kilogram of body weight, when administered orally.

TOXICITY ON INHALATION. Those which produce death within 48 hr. in half or more than half of a group of 10 or more white laboratory rats weighing 200 to 300 g., when inhaled continuously for a period of 1 hr. or less at a concentration of 2 mg. or less per liter of vapor, mist, of 2 mg. or less per liter of vapor, mist, illicity to provided such concentration is likely to product a used in any reasonable foreseeable manner.

TOXICITY BY SKIN ABSORPTION. Those which produce death within 48 hr, in half or a group of 10 or more tablita tested at a dosage of 200 mg. or less per kilogram body weight, when administered by continuous contact with the bare skin for 24 hr. or less.

The foregoing categories shall not apply if the physical characteristics or the probable hasards to humans as shown by experience indicate that the substances will not cause serious sickness or death. Neither the display of danger or warning labels pertaining to use nor the toxicity tests set forth above shall prejudice or prohibit the exemption of any substances from the provisions of these regulations.

SEC. 356 CARBOLIC ACID (PHENOL), NOT LIQUID must now be, packed as follows:

(1) Spec. 5, 5A, 5B, 6A, 6B, or 6C returnable metal drums.

(2), (8) Spec. 11A or 11B wooden barrels or kegs with inside metal drums fabricated from metal not thinner than 26 ga. Inside containers may also be glass or earthenware of not over 1 gal. capacity each, or metal of not over 2 gal. capacity each.

each.

(4), (5), (6) Spec. 12B fiber boxes with inside containers which must be (a) Metal cans of not over 2 B. b. capacity each or of not over 1 gal. capacity each. (b) Glass or earthenware containers of not over 1 qt. capacity each with not over 65 lb. gross per package. It is also authorized for the emergency to pack in glass or earthenware of not over 1 gal. capacity earthenware of not over 1 gal. capacity 75 lb. If capacity of inner containers is greater than 5 pints each not more than four containers may be shipped in one package.

(7), (8) Spec. 15A, 15B, 15C, 18A or 19A wooden boxes with inside containers which must be (a) Glass or earthenware containers of not over I gal, capacity each except 2 gal, capacity in authorized when only one is shipped per package. (b) Metal cans of not over 10 gal, capacity each. Also metal inside containers Spec. 2F are authorized with maximum capacity of not over 250 lb.

(9) Spec. 17E, 17H, or 37D. Metal drums (single-trip). Net weight not over 475 lb.

(10) Spec. 27G. Metal drums securely cushioned with sawdust or rice hulls in outside wooden barrels, net weight of contents not over 250 lb. Outside containers must be marked as prescribed in § 73.25.

(11) Spec. 27H. Metal drums (single-trip). Net weight not over 200 lb. each.

(12) Spec. 42B or 42C. Aluminum drums.

(13) Spec. 103, 103W, 103A, or 103A-W

(14) Spec. MC 300, MC301, MC302, or MC 303. Tank motor vehicles.

SEC. 357(a)(12) Cyanides or cyanide mixtures may now be shipped when packed in Spec. 21B fiber drums in addition to those containers previously authorized. (a)(12) Spec. 21B. Fiber drums.

SBC 261(n) CLASS B POISONOUS SOL-IDS other than those for which special requirements are prescribed may now be shipped when packed in Spec. 31B fiber drums. This is in addition to previously authorized containers.



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Your answer to these and similar questions will enable us to engineer your installation so that it will give you the best, and longest service—at the lowest cost per load over the years.

Be sure you get the hoist installation best qualified to do your job. It's wise—and costs you nothing—to get the facts first, rather than to make expensive changes later.

May we place our experience of a great many years of successfully designing all types of hoist installations at your disposal?



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# Here's

the dope on 2

MPERVIOUS GRAPHIT

The new No. 240A is a shell-and-tube heat-exchanger made of "Karbate' brand impervious graphite ... similar in construction to the familiar No. 70A...but with almost three times as much total effective external heat transfer surface. Advantages are:

- 1. 70.6 sq. ft. of external heat transfer surface.
- 2. Single, double or four-pass routing of tube-side fluid is effected by a simple change of fixed and floating end-cover assemblies.
- 3. Wide variety of corrosive fluids handled with negligible maintenance.
- 4. Thermal shock resistance.
- 5. Very high heat transfer rates.
- 6. Stainless steel baffles.
- 7. Easy tube replacement in the field.
- 8. Removable "Karbate" tube bundle.
- 9. Steel shell aversize shell connections, impingement plates and drain and vent plugs integral with shell end casting.



This exchanger is smaller in capacity than the 240A. Possesses all of the advantages listed above for the 240A. For complete information on these two heat exchangers, write for catalog sections S-6715 and S-6690. Address National Carbon Division, Dept. CE.



A LITTLE PICK-ME-UP OF H2 SO4 MAY HELP THAT INDIGESTION I'VE BEEN GETTING FROM KARBATE IMPERVIOUS GRAPHITE

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the revolutionary new "Eveready" No. 1050 light Battery you get these big exclusive features:

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Why? Because of the exclusive "imide-out" construction of the "Everendy" No. 1050 battery. Instead of being the container for the cell, the zinc etectrode is on the inside to make the battery last le while the new outside carbon jacket makes the b laskproof. Order a supply of No. 1050's today.

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 SULPHURIC ACID CUTTERS
 HYDROCHLORIC CID ABSORBERS

## Construction Materials in the Paper Industry Part IV—Alkaline Pulping





Two applications of Worthite pumps in soda pulping operations. At the left-black liquor evaporator installation, and at the right-green liquor circulation system.

### Worthite

W. E. PRATT, Worthington Pump and Machinery Corp., Harrison, N. J.

The alkaline pulping processes employed in the paper industry are: (1) the soda process, (2) the sulphate (kraft) process, and (3) the semichemical process—based on one of the above.

The percentage of pulp made by these processes has been increasing by leaps and bounds in the last decade. The big boost for the sulphate process followed the successful development for pulping southern pine although many other woods are now processed by this method.

The corrosion problems in the straight soda process are relatively mild. The sulphate process is essentially the same up to the smelt furnace where sodium sulphate (Na<sub>2</sub>SO<sub>4</sub>) is added which supplies the sodium sulphide (NaS),—the important active agent in the digester liquor. It was not recognized at first by many in the industry that the presence of Na<sub>2</sub>S in the black liquor would increase the corrosive action on iron and steel to a marked degree, with the result that hundreds of thousands of dollars worth of equipment failed in service and had to be replaced by more resistant materials. Many of the older soda pulp mills are now adding small amounts of sulphate in recovery operations, so their corrosive problems are now on the increase.

Worthite is one of the alloys that

shows practically perfect resistance to the corrosive action of the sulphate digester liquors. Worthite also is highly resistant to the corrosive crosive conditions existing in the handling of the black liquor-salt cake slurries for the furnace feed, and to the various abrasive slurries encountered in the recausticizing plant.

Typical of the results of early tests on Worthite for handling the black liquor encountered in the recovery plants in these processes, is this report: "A pulp mill exposed a specimen of Worthite to black liquor in the dehydrator, at 300 deg. F. for 55 days and reported no loss".

This test led to the use of Worthite pumps in this plant on all black liquor, green liquor and white liquor services. The plant now has purchased over the last 12 years a total of 78 Worthite pumps.

The pump that feeds the concentrated black liquor, mixed with salt cake, to the smelting furnace, is not subjected to the corrosive Na<sub>2</sub>S which is formed in the furnace. The service is especially severe, however, due to the presence of the abrasive salt cake crystals. Worthington developed a special pump for this service about 15 years ago and it has been used in over 90 percent of all installations made since that time. Casings are of tough nickel iron. Impellers made of steel, 13 percent chrome stainless steel, 18-8 stainless steel, Monel, and finally Worthite were tried out. Worthite has been standard for the last 10 years

Part IV of a symposium in which materials of construction are evaluated for various services in the paper industry. Parts I, II, and III were concerned with stock handling, bleaching, and acid pulping respectively.

as it not only gives the longest service (3 to 8 years) but it costs less per year of service. This record on Worthite impellers has led some mills to use all-Worthite pumps for the furnace feed.

Other services in alkaline pulp, black liquor recovery plants for which Worthite pumps are widely used are:

(1) Evaporators—feed, transfer, discharge, condensate; (2) Black liquor—to and from the cascade, pulp washers, spray-circulator, blow pit stock, ash removal, and for alloy-internal pump parts for weak black liquor of less than 15 percent solids; (3) Green liquor—dissolving tank circulators and transfer; (4) Limemud; (5) Causticized liquor slurry; (6) White liquor—to clarifier, transfer and filling; (7) Dregs washer; (8) Clarifier underflow mud; (9) Filter feed; Black ash leaching—washer circulating; and (10) Carbon washers circulating; and (10) Carbon washers

Worthite pumps are considered by users to be more economical than "sand pumps" made of very hard metals, for some of the above slurry services. While Worthite is not a hard metal, it is exceedingly tough, and with its superior corrosion resistance it actually does give excellent results if the pumps are properly applied and operated. By this is meant that the pump must: (1) be supplied with the slurry in proper suspension, (2) have a static suction head that prevents air entering the suction line, (3) be provided with the required NPSH, (4) not be required to handle high percentages of solids larger than 50 mesh, and (5) be of a size that permits operation near the capacity represented by the maximum efficiency point. This latter is most important for long life as otherwise cavitation or churning (eddy losses) will greatly reduce the useful life.

(Continued)



## CILTER ABRICS

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### Carbon

L. C. WERKING, National Carbon Div., Union Carbide and Carbon Corp., New York, N. Y.

Carbon linings for alkaline pulp digesters have been used since 1931. The use of these linings affords positive protection to mild steel digesters under present day operating conditions, which have made the use of unprotected shells impractical from the corrosion standpoint.

As carbon brick is completely resistant to chemical attack and rarely subject to spalling, life in the order of 15 years has been observed.

Since 1931, 45 carbon brick linings have been (or are about to be) applied to digesters, both riveted and welded, in all the known modifications of alkaline cooking and alternate alkaline and neutral cooking.

Practically all linings installed prior to 1948 employ a thickness of 5 in. More recent installations use newly developed, high-compressive strength brick which are laid to give a 3 in. thickness without sacrifice of strength or chemical resistance.

Extensive inspections demonstrate that carbon linings can be expected to give complete protection to digester shells in all alkaline pulping processes currently in use.

### Cements

RAYMOND B. SEYMOUR, Atlas Mineral Products Co., Mertztown, Pa.

Because of the general opinion that steel is completely resistant to alkalis, progress in combatting corrosion in the sulphate and kraft processes through the application of corrosion resistant cements has been much slower than in the sulphite process. However, operators who have studied the life of unprotected iron shells have concluded that sound economics demands that alkaline pulping process digesters be protected. Unfortunately, shale bricks are not completely satisfactory for alkaline service but carbon bricks joined with modern furfuryl alcohol resin cements appear to be completely satisfactory for the sulphate process. Cements based on silicates, sulphur, phenolic resins and glycerine-litharge are completely unsatisfactory for alkaline service.

Part of an alleged decrease in resistance of unprotected carbon steel digester shells has resulted possibly from changes in corrosion rates of the process rather than from a decrease in the corrosion resistance of steel. Recent studies have shown that the use of carbon brick joined with furfuryl alcohol resin cements increases the cost of a digester by less than 50 percent but prolongs the life expectancy by at least 100 percent. The cost of stainless steel is about double the cost of a carbon steel digester and considerably more than carbon brick lined digesters joined with properly selected cements.

Furfuryl alcohol resin cements are usually prepared by mixing two parts by weight of powder with one part by weight of the liquid resin and the resulting cement gives excellent adhesion to carbon brick. The working time of these cements varies from 90 min. at 60 deg. to 15 min. at 90 deg. These cements are completely cured and ready for alkaline service after three days at 70 deg. F. They have a coefficient of expansion of 6 × 10°, a water absorption of less than 0.4 percent and are completely resistant to caustic in all concentrations at temperatures up to 380 deg. F.

### Durimet 20

WALTER A. LUCE, The Duriron Co., Dayton, Ohio-

Durimet 20 has not found the same application in alkaline pulping processes (either soda or kraft) that it has in the acid pulping process described in the previous part of this symposium. The reason for this limited use of Durimet 20 is that the corrosive conditions are not as severe in the alkaline process and consequently such materials as steel, chrome steel and the conventional 18-8-S stainless steels have found successful application for most of the services encountered. However, there are specific services, especially those in the black liquor recovery system, that are extremely destructive. The trend is to incorporate more resistant materials of construction for these special services and the superior corrosion and erosion resistance of the higher alloyed stainless steels, such as Durimet 20, makes them an economical selection.

For the most part these superior stainless steels are used as pumps and valves where this increased resistance to erosion-corrosion is beneficial. For instance, these pumps are used in kraft mills for handling all solutions in the recovery system. In certain locations the conditions are necessarily more severe due to the presence of abrasive materials in the system. In fact, one Durimet 20 pump was made with a Chlorimet 3 (Nickel base alloy containing 18 percent Cr and 18 Mo) impeller to obtain even gerater erosion resistance to the lime shurry from the slaking tank. In this latter service, im-

(Continued)

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CORROSION FORUM, COUR. . .

pellers made from the Durimet 20 type alloy were eroded in six months while steel provided less than three months' service. Durimet 20 plug valves are also being used for certain services in the black liquor recovery process where steel valves were generally unsatisfactory.

Durimet 20 has a nominal chemical composition in the cast form of 29 percent Ni, 20 Cr, 2 Mo, 3.5 Cu, 1 Si, 0.07 C max. and balance Fe. It is available in the form of castings and equipment from castings such as pumps, valves, fans, ejectors, jets and mixing nozzles. The wrought form of this alloy is produced by the Carpenter Steel Co. under the name Carpenter Stainless No. 20. Presently the wrought alloy is available in the form of wire, rod, bar, strip, sheet, plate, welded pipe and tubing. Welding electrodes in this analysis are also available.

## **High-Silicon Irons**

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

The high-silicon iron alloys find practically no application in the soda pulp or kraft processes because of the satisfactory service of other alloys, such as steel, chrome steels and others. Generally, the high-silicon iron alloys provide no advantage over cast iron and steel in alkaline solutions and this, of course, restricts their use.

Duriron is a high-silicon iron alloy containing 14.5 percent Si, 0.75 Mn. 0.90 C and balance Fe. It has good erosion resistance due to its extreme hardness (520 Brinnell) and therefore, has found a very limited application in alkaline pulping to handle severe erosion services. For instance, a Duriron pump was used by one soda pulp mill to handle the lime slurry from the bottom of the slaking tank and is providing satisfactory service after more than two years' continuous operation. One other mill reports good service from a Duriron pump on black liquor. This is another erosion service due to the presence of abrasive wood products from the digester. In these severe erosion or abrasion services, Duriron has proven to be an economical selection.

Because of the aforementioned hardness, any machining on Duriron must be accomplished by grinding methods. Nevertheless, this alloy is available in many forms of chemical equipment, such as pumps, valves, eiectors, pipe, tank outlets, jets, fans and spray nozzles. Durichlor contains 3 percent Mo in addition to the Durichlor contains.

iron analysis, but this provides no superiority for alkaline solutions.

### Chlorimets

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

Chlorimet 2 (63 percent Ni, 32 Mo) and Chlorimet 3 (60 percent Ni, 18 Cr, 18 Mo) find practically no application in alkaline pulping. These alloys are economical only for very severe services where other less expensive alloys will not suffice. However, many plant men are becoming more conscious of the severe erosioncorrosion problems in their mills and are investigating the use of the higher alloys. In one mill a Chlorimet 3 impeller was substituted for Durimet 20 in a pump to handle a lime slurry from the slaking tank. Impellers in the latter type alloy only provided six months' service before being severely eroded. The superior erosion resistance of Chlorimet 3 should considerably extend this service life. Chlorimet 2 has not been used in any phase of alkaline pulping.

### Iron and Steel

ARTHUR E. MAY, Moore and White Co., Philadelphia, Pa.

ALBERT W. SPITZ, Reiter Engineering Co., Philadelphia, Pa.

Iron and steel are extensively used in alkaline pulping and were at one time used exclusively.

As in sulphite pulping, log conveyors, barkers, chippers, chip screens and elevators of low carbon steel and cast iron are quite satisfactory.

In the digester room, liquor storage tanks, digesters, pumps, liquor heaters, heat exchange equipment and piping are generally made of carbon steel and cast iron. In recent years, however, digesters of stainless clad construction have somewhat replaced carbon steel, and stainless sheet has been used to extend the life of existing carbon steel digesters.

Carbon steel piping and all iron valves are predominantly used for white and black liquor. In some instances, the use of more resistant materials for black liquor handling may prove most economical.

Cyclone separators, heat reclaiming equipment, and blow tanks of carbon steel are satisfactory.

Cast iron and carbon steel are acceptable for constructing knotters and screening equipment prior to the actual paper making operations.

actual paper making operations.

In the evaporation and chemical recovery step, black liquor storage tanks, multiple effect evaporators (ex(Continued)

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CORROSION FORUM, cont. . .

cept for one stage which is generally stainless steel, and disk evaporators are of carbon steel construction.

Smelt dissolving tanks, piping and valves were formerly made of cast iron and carbon steel; more resistant alloys are now used.

In the causticizing system carbon steel equipment is satisfactory for clarifiers, lime storage and handling equipment, slakers, causticizers, sludge washers and the lime burner shell. In general, the corrosion problems in this step are minor.

### Rubber

JAMES P. McNAMEE, U. S. Rubber Co., Providence, R. I.

The manufacture of paper by both the soda process and kraft (sulphate) process come under the classification of alkaline pulping. The soda process uses a sodium hydroxide solution as a cooking liquor and the kraft process utilizes a solution consisting of sodium hydroxide, sodium sulphide and sodium carbonate.

Neither of these processes involve extreme corrosion conditions and as a result, rubber lined steel has not found extensive application as a material of construction in these plants. Both soft and hard rubber lined steel are unaffected by the various digesting liquors and byproduct liquors used in the alkaline pulping operations, however, and may be used where metal protection is desired.

Rubber linings can be applied to process and storage tanks, pipe, fittings, valves, pumps and agitators. Soft rubber can be used at temperatures below 150 deg. F. and hard rubber will operate as high as 180 deg. for regular grades and 220 deg. F. for special grades. Sheet neoprene linings are resistant to strong sodium hydroxide solutions at elevated temperatures and are particularly adapted for transportation equipment where strong caustic must be heated in order to remove it from the tank.

Solid plastic pipe is resistant to alkalis and may be used to handle sodium hydroxide solutions. This type of pipe is very convenient to use since it can be purchased in stock lengths and cut to size in the same manner as steel pipe.

### Nickel, Nickel Alloys

H: O. TEEPLE, International Nickel Co., New York, N. Y.

Alkaline pulping may utilize either (Continued)

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CORROSION FORUM, cont. . .

one of two alkaline liquors, sulphate or soda. The sulphate process or otherwise known as kraft process consists of cooking wood chips with a solution composed of a mixture of sodium hydroxide and sodium sulphide. The soda process consists of cooking wood chips with a solution of sodium hydroxide. Since the corrosion problems emanating from each of these two alkaline processes are different, they will be discussed separately.

#### SODA PROCESS

Generally speaking, the corrosion problems encountered in soda pulping are not severe. Carbon steel and cast iron are used frequently with fairly good results.

Carbon steel, for example, has proved to be economically suitable for soda digesters and in some mills, service lives up to 30 or 40 years have been achieved.

In some critical services, Ni-Resist has replaced cast iron, particularly pumps and valves. For example, Ni-Resist digester blow valves have been used with good results.

An important application of Monel in soda pulping is the use of Monel for black liquor evaporator tubes, particularly in the strong liquor effects. The following data indicate the suitability of Monel for this purpose:

Corrosion of Black Liquor Evaporator Tubes-Soda Process

in tost for 57 days in 55% solids soda

bmerged in first effect evaporator. Corresion Rate, In . Per Yr Material Monel Carbon steel 0.006

Other useful applications of Monel are in handling green liquor and in lime sludge filters for filter elements and wire cloth covers. The latter use of Monel is particularly effective because of frequent cleaning of the filters with hydrochloric acid.

### SULPHATE PROCESS

The corrosion problems arising through the use of a sulphate cooking liquor are generally more severe than those of the soda process. These problems assume major importance because of the extensive use of the kraft process all over the U. S. and Canada.

By and large within the space of the last five to eight years a great many mills have encountered serious digester corrosion problems. The point is that formerly carbon steel digesters would last ten to twenty years and recently service life has decreased to the order of three to five years. The prime reason for the noted increase in corrosion of the digesters is obscure at the moment. Undoubtedly there are several contributing factors responsible for decreased digester service life. Some of these factors are real and capable of evaluation.

The current approach to this problem by many pulp mill people appears to be in the direction of using a digester lining of some suitably resistant material. This approach includes the use of shop or field applied linings which might be an alloy or an alkali resistant brick such as carbon brick. It includes also the use of alloy clad

steel plates.

As far as Monel, nickel and In-conel are concerned for sulphate digester service, the only one possessing sufficient resistance to corrosion by the alkaline sulphide cooking liquor is Inconel. The resistance of Inconel to corrosion by kraft cooking liquors is quite high, being of the order of 0.0005 ipy. Other properties of Inconel permit its use as a resistance welded, shop-applied lining or as a clad steel. Inconel also has two very strong important properties which are conducive to the use of this alloy for field applied linings to existing digesters. One of these properties is that its thermal coefficient of expansion is practically the same as that of carbon steel, thus high internal stress levels do not occur during the normal working of a digester. The other important factor is that tests have shown Inconel is not subject to embrittlement by hot concentrated white liquor or mixtures of white and black liquors, i.e. cooking liquors. These two important factors coupled with the favorable welding characteristics of this alloy place Inconel in an outstanding position for sulphate digester

The following corrosion data illustrate the serviceability of Inconel for sulphate cooking liquor service:

### Corrosion in Cooking Liquor Service-Sulphate Process

Plant corresion test for 35 days on liquer side of indirect substate liquer heater at an average temperature of 300°F. Liquer average fem velocity 4 fps. Corrosion Rate, In. Per Yr.

Material 0.0003 Inconel Mild steel

Plant corrosion test for 31 days in blow end of rotating kraft digester cooking 90% hem-lock and 10% spruce. Temperature 356 F.

Material Corrosion Rate, Ip. Per Yr. Inconel Mild steel 0.0007

C. Plant corrosion test for 31 days in blow end of rotating kraft digester cooking western red codar. Temperature 250°F. max. Material Corrosion Rate, In. Per Yr. 0.0000 Income! Mild steel

(Continued)

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## WELDING STAINLESS ALLOYS

Norman S. Mott

Chief Chemist and Metallurgist The Cooper Alley Foundry Co.

In the welding of stainless alloys, four types of composition have to be taken into consideration—the hardenable martensitic straight chromium group; the nonhardenable ferritic straight chromium group; the corrosion resisting chromium-nickel group, and the heat resisting chromium-nickel group. These alloy compositions have, in varying degrees, greater thermal expansion and lower thermal conductivity than carbon steels, and in some instances have carbide mannerisms which affect corrosion resistance.

When the torch flame or arc is applied, the metal is heated to a very high temperature only in the area being welded. The heated metal expands and tends to push out in various directions against the colder surrounding metal, producing severe internal stresses. When the heat source is removed. the resultant contraction produces pulling stresses acting between the cooling and the cold metal. If the metal does not have sufficient ductility to stretch and accommodate itself to these great stresses. cracking will result. This is most prevalent in the lower ductility straight chromium grades. By making temperature gradients as gradual as possible, this danger can be minimized.

In the chromium-nickel corrosion resisting alloy types, a form of grain boundary carbide precipitation occurs during welding. To offset the dangers of intergranular corrosion, these carbides must be put into solution by subsequent heat treatment before the welded metal is put into use.

Difficulties which are involved in welding cast stainless steel can be overcome through the use of pre-welding and post-welding thermal treatments as indicated below. Alloys for heat resistance 'ADVERTISEMENT

applications usually do not require any thermal treatment after welding.

ALLOY REMARES

Prehent to 400° F. or over. After welding, cool to not less tham 300° F. then heat to 1850° F. . . . hold for I hour, furnace cool to 1350° F. hold 5%Cr for 2 hours, then air cool.

Preheat to 400° F, or over.

After welding, cool to not less than 300° F, then heat to 1350° F. . . . held for 2 9%Cr

to 1350° F. . . hold for 2 hours, then air cool.
Preheat to 400° F. or over.
After welding, cool to not to 1350° F. . . . hold for 4 12% Cr

18% Cr

hours, then air cool.
Preheat to 250-300° F. After
welding, cool to 250° F. or
welding to then heat to 1450°
F. . . . hold for 4 hours, then

air cool.

Preheat to 250-300° F. After welding, cool to 150° F. or lower, then heat to 1450° F. . . . held for 4 hours, then 18%Cr

air cool.
Prehect to 250° F. or over.
After welding, heat to 1850°
F. . . . hold for 2 hours, then
rapidly air cool. If distortion
is feared stress-relieve weld
for 1 hour at 1350° F. followed by air cooling.
Preheat not required. After
welding heat at 2000° F. for
1 hour, then water quench.
Preheat not required, nor is
post heat. However, after
welding, it may be stressair cool. 27% Cr

19-85

18-85Cb post heat. However, after welding, it may be stress-relieved at 1850° F. for 2

relieved at 1890° F. for 2 hours followed by air cooling. Preheat not required. After welding heat at 2000° F. for 1 hour, then water quench. Sufficiently ferritic alloys can often be used without post 18-85Ma

heating. Preheat to 400° F. at to 400° F. After ng cool very slowly heat to 2000° F. . . . FA-20 1 hour and water

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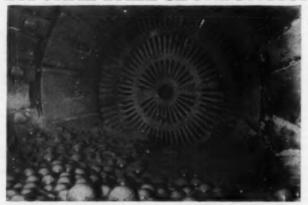
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D. Plant corresion test for 310 days in a West Cuart sulphate digester. Corrosion Rate, In. Per Yr. Material

In the liquor recovery systems in the sulphate pulping industry, Inconel is quite suitable for black liquor evaporator tubes as the following corrosion data will exemplify:

Corrosion of Black Liquor Evaporator Tubes-Sulphate Process

on test for 68 days in finishing ecimons fastened to the upper Temperature 258°F. Corrosion Rate, In. Per Yr.

0.0001 0.009 0.056 0.002

As in the case of soda pulping, Monel is quite useful in handling green liquors and in the causticizing of the green liquor. The following cor-rosion data illustrate the usefulness of Monel for these applications:

Corrosion in Green Liquor

Corrosion Rate, In. Per Yr. 0,0008 0,0004 0,0001 0.0025

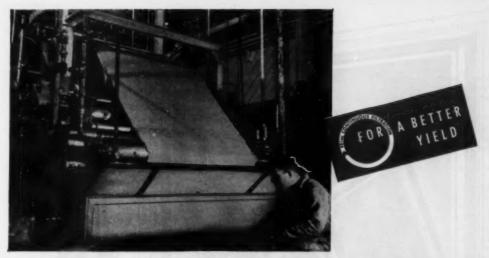
Corrosion in Causticizing Unit

Plant corression test of 35 days duration. Symmetre immersed in Durr agitator in causing unit for sulphate green liquor. Licomposed of 86 gpt. NaOH as NaO, 35 as Na<sub>C</sub>O, 31 gpt.Na<sub>C</sub>N, some CaO<sub>D</sub>, site and some cilica. Temperature 199–28 Corrosion Rate, In. Per Yr. Material

6.0008 0.0002 0.0001

Monel, nickel, Inconel and Ni-Resist find useful application in alkaline pulping and in a great many instances they have proved themselves to be the most economical material choices. -End

Note: In the Nov., 1950 Corrosion Forum, credit for assistance given by O. R. Huggenberger, Dominion Rubber Co., Ltd., R. H. Biddle, West Virginia Pulp and Paper Co., M. G. Lyon, Champion Paper and Fibre Co., and P. B. Davidson, Strathmore Paper Co, belongs with the article on coatings versus bleaching in the paper industry-not with the rubber article, under which it appeared.



## BETTER RECOVERY OF Solubles with less dilution on FEinc FILTERS

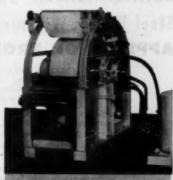
You squeeze the greatest profits from valuable clear filtrates in three ways with the FEinc rotary vacuum filter. First, the FEinc compression dewatering mechanism removes 2% to 6% more of the valuable filtrate from the cake. Second, the FEinc submergence type washing mechanism, with a compression belt to close up cracks and prevent "channeling" of the wash water, washes out more solubles with less dilution. Finally, the famous FEinc String Discharge, which lifts the cake neatly from the drum on strings, makes "blow-back" unnecessary, and saves the small amount of filtrate that often is blown back into the cake. Look at these actual cases:

Muddy overflow containing fine solids resulted from centrifuge removing extract from ground, cooked liver pulp. Since both cake and filtrate were valuable, processes that contaminated cake with filter medium could not be used. FEinc filter saved cake and gave filtrate so clear that the job could be finished by very small polishing filter.

Penicillin manufacturer switched to FEinc String Filters when he found centrifugal separators were losing valuable culture broth. Continuous FEinc dewatered so well it even gave time to do a little washing, recovered more broth.

Attempts to separate two oils by filtering out the oil that crystalized at a certain temperature were unsuccessful with ordinary filter. Blow-back returned oil to cake, and scraper smeared cake into cloth. FEinc String Discharge filter now gives firm, clean filter cake, without cloth plugging.

ASK FOR FEinc technical bulletin No. 103. Just phone or write. Better still, send five gallons of slurry for free tests to:

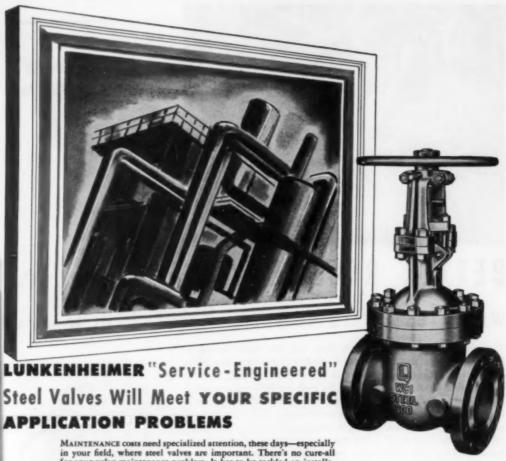




TECHNICAL BULLETIN



FILTRATION ENGINEERS INC. 155 ORATON STREET - NEWARK 4, NEW JERSEY



MAINTENANCE costs need specialized attention, these days—especially in your field, where steel valves are important. There's no cure-all for your valve maintenance problem. It has to be tackled an installation at a time — service by service — and that's where Lunkenheimer engineering comes in.

In the complex process field, valves must be perfectly suited to their service. If you fail to get a perfect match, your maintenance costs are bound to be high. From Lunkenheimer, you get not only valves designed with a service in mind, but exclusive features available from no other manufacturer. Investigate the new patented alloys developed through Lunkenheimer leadership in metallurgical research. See for yourself that all valves are not the same . . . that Lunkenheimer castings are denser and sounder, because of their special method of manufactures.

facture... that special Lunkenheimer trim is carefully selected for its service application... that stems, bodies, bonnets, gaskets, and even bolts are all coordinated and 
temperature-rated to give you the correct 
Lunkenheimer valve for your specific needs. 
Call in the Lunkenheimer representative in 
your area. He'll be glad to put at your command all the generations of successful experience behind Lunkenheimer's complete 
selection of "service-engineered" steel valves. 
For his address, write The Lunkenheimer 
Co., P. O. Box 360P, Cincinnati 14, Ohio.

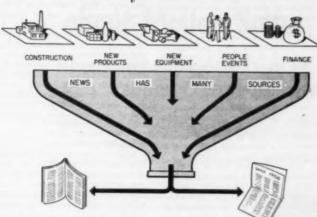
STEEL . . . IRON . . . BRONZI

## LUNKENHEIMER

THE ONE GREAT NAME IN VALVES

L-850-118

## The Human Equation Edited by Richard L. Demmerle



## The News Hopper Must Be Fed

"Publicity" was once a tainted word. The appearance of purposely proffered information in print implied that hungry, thirsty or aquisitive members of the fourth estate had been wheedled into doing the bidding of conniving press agentry. As a result liaison between the latter and gentlemen of the press was openly frowned upon, though secretly employed, by many "nice" individuals and companies who wanted a pitch in print.

How times have changed! In a recent survey conducted by the University of Illinois 100%, yes—one hundred percent, of the manufacturing concerns, utilities and banks questioned said that publicity was the primary function of their public relations programs. Though 18 other high sounding public relations duties were variously mentioned it was the once earthy—now respected publicity work that proved to be the common denominator of all surveyed. The poll left no doubt that the earned appearance of the private word in the public press has become a wholesome industrial practice. It's also darned good business.

But good publicity rests squarely on the quality of the press releases that prompt it. And all the fine efforts to establish good rapport with editorial men, as described in this column last month, are of no avail unless there is adequate follow-through by well written press releases.

Perhaps the point where most writ-

ers of fruitless releases go awry is right at the beginning . . . . by the bad diagnosis of the news angle. The best definition of news says that it is anything of interest to people. Invariably this means anything about people or their doings.

Writers of industrial news releases often forget this fact and limit themselves to announcements of new products and new equipment. No publication could exist very long by offering its readers a steady diet of information about inanimate objects. Human interest stories have become as necessary in industrial publications as they have always been in other publishing fields. Can anyone deny that the all time best seller, the Bible, has great human interest?

### WHAT IS NEWS?

General Mills Inc., fully cognizant of the human interest value in publicity suggested to its branch offices that the following topics are good sources of company news:

Promotions'
Appointments
Anniversaries
Safety Awards
Meetings
Distinguished Visitors
Open Houses
Exhibits
Banquets
Conventions
Deaths
Accidents

These items, of course, are in addition to information on new research discoveries, new products, new processes and new construction.

But regardless whether it is about person, product or process the good news release must carry its message in simple terms to perform its mission! "Five little jobs have I

To answer who, what, when, where and why."

By tradition the lead paragraph should contain all the vitals of the story, leaving the rest to unfold in order of diminishing importance. This enables the editor who is short on space to cut the story easily and still get over the important facts. In industrial stories it is usually necessary to add a "how" to the five famous "w's."

The mechanics of composition of a news release are few and simple . . . . so easy in fact that it is surprising to note how many writers fail to observe

- 1. All copy should be typewritten.
- Use one side of the paper only.
   Double space all copy.
   Write the name address and
- Write the name, address and telephone number of the source organization in the upper lefthand corner of page 1.
- Leave a two inch space for headline insertion or editorial remarks below source address.
- 6. Type release date on right hand side.
- 7. Use the word "More" at the end of each page if the story continues.
- 8. If the story requires more than one page, write a phrase identifying the story in the upper left hand of each page following page I.
- 9. Use the symbol ### at the end of story to signify conclusion.
- Wherever possible keep paragraphs to five or six typewritten lines.

If this treatment is followed newsworthy technical developments will receive adequate and fair attention in the publications of the fields concerned. But the writer should not feel dejected if his deathless copy about a new sump pump fails to appear in the pages of the "Daily Blab." It generally takes the human interest content of a miracle drug or a new floor wax to promote technology onto the front pages of the daily press. Witness only a few years (Continued) NEWS IS NOT AN AD

ago when a new mosquito repellent was seized upon almost unanimously by the large newspapers as the outstanding news story of a week long convention of chemists.

For this reason optimum coverage in both the popular and the industrial press is best obtained by the use of two or more appropriately slanted releases. Some times it may take as many as four or five versions of the same story to meet the needs of the reporter on a daily, a Sunday supplement feature writer, the editor of a trade magazine and his counterpart on the staff of a professional journal.

A release about "tailor-made soap-less soaps that make water wetter" would frustrate and madden the industrial editor. Similarly the description, "synthetic surface-active agents containing hydrophilic and hydrophobic groups" would soar right over the head of the scribe for the "Daily Blab."

Both worthies, however, would be left cold by the use of misty adjectives as glamorous, sensational, collosal and the like. And such stellar terms of huckster chemistry as "wettier, lockedin scrubbing power" would slide down the editorial drain to the wastebasket.

It's sad and somewhat strange that so many of those who compose press releases seem to nurse a secret desire to write advertising copy. The basic purpose of the release, the transmittal of information to the press, is all too often subordinated to a selling urge. As a result editorial men, to preserve the character of their publications, have had to develop a formidable armor of sales resistance against the frothy release. Cute sounding trade names, unless substantiated by the actual technical name of the product, can't hope to break down this resistance. Neither can releases about a radically improved design of an equipment unit that involves the replacement of a left-handed screw with its right-handed twin.

But overmodesty can be as bad as immodesty in the press relations business. A large processing company after spending a couple of hundred thousand dollars in the successful development of a new process, broke the story by writing one publication a halting, blushing letter. What a contrast this provided to another outfit who a week before had picked up the sizeable tab for a large press party at which a new bottle washing compound

was unveiled.

Releases about new equipment and new products can achieve for the source company a valuable amount of sales conditioning with which to preface an active sales and advertising campaign. This conditioning is best done, however, by factual informa-tion which creates the reception for the ad copy or salesmen that follow. Photographs, and illustrations of high quality and containing a modicum of imaginative composition can extend or even supplant the release dramatically. But a lovely girl in a bathing suit (or a reasonable facsimile thereof) belongs on a beach, and not perched atop a unit of plant equipment or a pile of ammoniated fertilizer.

#### THE HUMAN STORY

Many managements and press relations departments overlook the value of releasing information about the human workings of a company. Transcripts of their president's speeches sometimes make reproducible reading. But they've got to be darned good to surpass the human interest value inherent in a story about the increased working efficiency that resulted from painting the walls of the company cafeteria a light restful shade of green.

Labor relations and financial matters are no longer shrouded in the hush that once surrounded the mere mention of Freud. Today when an efficient labor contract or financial step is negotiated most companies feel proud of their accomplishment and wish to announce it to the rest of the community and the world in general. Again this is the kind of situation in which the well written press release can do a yeoman job of public relations. In such cases it becomes a cornerstone for sound community relations.

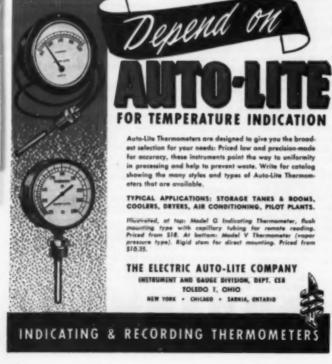
In such matters background information in the handout is highly desirable. What was the situation that led up to the move? Who are the parties involved? What does it portend for

the future?

It's of limited value to announce that a wage increase has been granted unless the date and amounts of previous increases is given along with the living scale changes that prompted them. Similarly the announcement of a new stock issue or dividend becomes so much fuller and more attractive in print if the release carries information on the expansion or profits

that brought it into being. So goes the pattern of any good news release about anything from corporate dollars to catalytic crackers. It carries its message tersely and accurately, yet fully. It can't afford to occupy itself with hazy phrases. It's too busy telling a story.

-End



## What every H<sub>2</sub>SO<sub>4</sub> Producer should know about Molten Sulfur Filtration

## HERE'S HOW TO BOOST ACID OUTPUT AND REDUCE COSTS - IN ONE MOVE

Contact sulfuric acid producers can increase production considerably above rated capacity, and cut operating costs proportionately, simply by putting Niagara sulfur filters ahead of the burners.

These are the proved results of Niagara filtration in existing contact acid plants:

REDUCTION OF SHUTDOWNS THROUGH DIRT ELIM-INATION... Filtration removes the cause of shutdowns, by eliminating dirt before it enters the acid train. Niagara-filtered sulfur has an average ash content of .005% or less.

LOWER OPERATING PRESSURE... As a result of ash reduction, pressure rises are infinitesimal. In one plant, pressure rise in 3 years was a fraction of an inch vacuum.

LOWER CATALYST COST... Catalyst cleaning is almost eliminated. With dirt eliminated, the percent of dust actually carried into the converter is negligible.

CORROSION REDUCTION... The Niagara filtration process dehydrates and neutralizes the sulfur, with resultant decrease in corrosion from acid and moisture throughout the plant.

REDUCTION OF "PLUGGING AND SULFATING" . . . Pumps, guns and other equipment require less maintenance and cleaning, as a result of the purer neutralized sulfur.

SIMPLIFIED SUPPLY PROBLEMS . . . Off-color grades of sulfur may be processed, with good results.

### Saves Construction in New Plants

New contact acid plants can be constructed more cheaply if a Niagara packaged sulfur filter system is installed. Settling pits and gas filters can be eliminated.

Melting pits can be made smaller, since agitation



TONNAGE WENT WAY OVER RATED CAPACITY when this compact Niaguru Piller System was installed in 150-ten sulfuric acid plant, Filters handle 50 tens of molten sulfur each 24 hours. They

can be incorporated without danger of stirring up dirt from the bottom of the pits.

A Niagara sulfur filter system requires low initial investment, takes up little space, and needs no additional labor. Daily operating costs are usually less than one cent per ton of acid produced.

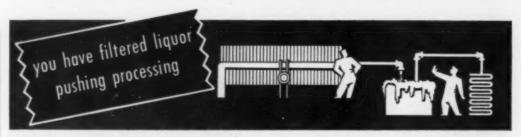
Modern sulfur filtration, which today accounts for some 2,000,000 tons of U. S. annual acid production, was developed and pioneered by Niagara engineers. Many Niagara sulfur filter systems are in operation throughout the country. For full details on the type of system that will best help your acid production in the present emergency, send in the coupon or write us today.



NIAGARA FILTER CORP., 2087 Main St., Settale 14, N.Y. Please send full information on Niagara Sulfer Filter	
Systems.	2000
Name	100
Title	1000
Company	350
Address	190
CI.	

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Latest published information concerning use of
diatomaceous filteraids.
Covers fundamentals of
filtration and describes
best methods of use.
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on request.

• Production costs are again becoming extremely important. A filter station that lags behind the rest of the plant can increase costs all the way down the line. The range of flexibility available when using Dicalite filteraids prevents this. A wide variation in the filterability of liquids can be readily handled, and output maintained at the desired level. Because brilliant clarity is assured by the inherent qualities of Dicalite filteraids, every following operation benefits by cleaner, clearer liquors, that produce higher quality products at lower cost. Send for your copy of the latest Dicalite Bulletin on filtration—No. B-12 We will be glad to supply as many copies as you need for key men in your filtration department.

DICALITE DIVISION, GREAT LAKES CARBON CORPORATION

NEW YORK 17, N. Y. . CHICAGO 13, ILL. . LOS ANGELES 17, CALIF.

## DICALITE FILTERAIDS

### MAN OF THE MONTH

Thomas H. Chilton

Pioneer delver into chemical engineering's basic concepts: winner of numerous professional honors; Du Pont's director of development engineering has now been elected president of AIChE for 1951.

Preciseness is the quality that sets the stage for introducing Tom Chilton. It characterizes the essence of the man, shows up in his every habit. His activities revolve around a desire to get to the heart of mattters.

This bent is apparent professionally and personally. Core of his career has been the discovery and formulation of principles underlying the unit operations and the application of these principles to process development, to equipment design and to chemical plant construction and operation. Hobbywise, he's the acknowledged historian and recorder for the Chilton family. He is also an authority on the fundamentals of the English language and has developed methods of improving English composition in engineering schools To his tailor and the casual observer, Dr. Chilton is a study in blue-gray. His hair and eyes having set the pattern, he follows through with a firm embargo against brown in his wardrobe.



Thomas H. Chilton joined du Pont in 1925; last May he added the company's 25-year pin to his trophies. After leaving Columbia with a chemical engineering degree in 1922, he spent three years in New York working with F. J. Carman on chemical utilization of natural gas. Their researches led to more efficient production of carbon black and later to the production of formaldehyde. He came to Wilmington as a chemist in the Experimental Station. The city has been his home ever

At first he worked on the pressure process for the oxidation of ammonia for the production of nitric acid. In 1929 he was associated with John H. Perry (of handbook fame) in studies on the improvement of the contact sulphuric acid process. Later that year the company organized a group of engineers to carry on fundamental research in chemical engineering, with Dr. Chilton as director. The group was gradually enlarged and in 1935 was consolidated with another division in the engineering department. Dr. Chilton was made assistant head of the new technical division. In 1938 he succeeded Henry B. du Pont as division head. Bulk of the group's work has been development of widely applicable design data for chemical

process equipment.
In 1939 he was awarded the Charles Frederick Chandler Medal for outstanding distinction in chemical science. In 1943 an honorary doctorate in science was conferred on him by the University of Delaware and he was cited also for the Egleston Medal. Both of these medals were awarded at Columbia. He has two badges that will remind him of his work in the manufacture of oxygen for the Armed Forces—a Presidential Citation and his gray hair which turned completely during the war vears

The Alabama-born engineer is a family man in more than one sense of the word. He is constantly picking up misellany on any and all branches of the Chilton clan. Mrs. Chilton and sons Tim and Dan share their Wilmington home with files full of old photographs, correspondence with remote relatives, records on births, deaths, marriages. A typical trip through the South is full of side excursions hunting down clues, for instance in epitaphs on old gravestones.

However, his effect on his relatives has gone beyond keeping them posted on vital anniversaries. The chemical engineering careers of two of his nephews were inspired by him. As an experiment, he recently subjected himself and son, Tim (college-aged), to a battery of vocational aptitude tests. The plan backfired some-what; Tim had the edge on him in the

chemical engineering field.

Carroll A. Hochwalt. New member of six-man executive committee of Monsanto Chemical Co., St. Louis. Continues as administrative director of the board of directors and vice president in charge of research, development and patent activities. Formerly first president of Chemstrand Corp.; remains a director. Joined the company in 1936 when the Thomas and Hochwalt Laboratories were converted to Monsanto's central research laboratories.

Henry Howard. Winner of the 1951 Perkin Medal. For 32 years con-nected with Merrimac Chemical Co.; ten subsequent years spent with Grasselli Chemical Co. as director of new products department. director of research and develop-

ment and consultant. Worked on sulphuric acid production, use of Spanish pyrites as a raw material, development of British Guiana bauxite deposits as chemical raw material. Long-time chairman of MCA; past president of AIChE and the Electrochemical Society.

Edgar C. Britton. President-elect of ACS for 1952. Director of organic research laboratory at Dow. Leader in development of new insecticides, weed killers and pharmaceuticals. Joined Dow 30 years ago. Studied at Wabash College and the University of Michigan.

F. Dudley Chittenden. Factory manager of U. S. Rubber's Marvinol vinyl resin plant at Painesville, Ohio. Joined the company in 1926 as a chemist. Studied chemistry at Yale.

Richard O. Roblin Jr. Chairman of the ACS division of medicinal chemistry for 1951. Director of the chemotherapy division of American Cyanamid Co., Stamford, Conn. Studied at the University of Rochester, Columbia, University of Munich and M.I.T. Associate ediitor of the Journal of Immunology, Virus Diseases and Chemotherapy. Joined American Cyanamid in 1934 as research chemist.

G. Russell Hersam. General sales manager of Prufcoat Laboratories. Co-inventer and developer of so-(Continued) called cocooning, a spray-packaging process used extensively in the lay-up of the fleet. Chemical engineering graduate of Northeastern. Former positions: technical assistant to the vice president, Oakite Products Inc. and later organizer and manager of the firm's technical service department; ordnance engineer in the U. S. Navy Dept.; chemical engineer in the Naval Ordnance Laboratories, Silver Springs, Md.

- F. M. Tiller. Winner of AIChE's Junior Award for outstanding contributions to chemical engineering literature. Associate professor of chemical engineering at Vanderbilt University. Known for his work in infrared radiation and gas absorption. Previous positions: chemist for Colgate-Palmolive-Peet; instructor at the University of Cincinnati. Schooling at the Universities of Louisville and of Cincinnati.
- Glen S. Watson. Resident technical director for the Marietta and Willow Island plants of American Cyanamid's Calco Chemical Division. Prior positions at Cyanamid: member of the Bound Brook research staff, assistant divisional chief chemist in the azo dye department, and most recently, chief chemist of the Marietta works. Graduate of West Virginia University (Ph.D., 1936).
- Anthbny J. Fischer. Assistant manager, development department, Dorr Co., Stamford, Conn.; has been sanitary development engineer. Joined Dorr in 1928. Alumnus of the University of Pennsylvania and Rutgers.
- Bryant Fitch. Assistant research director. Came to Dorr in 1944 from American Potash and Chemical Co. Graduate of Cal Tech.
- Robert T. Haslam. Recipient of an American Petroleum Institute Certificate of Appreciation for organizing in 1946 the first national oil industry public relations program. Retired vice president and director of Standard Oil of N. J. (See Chem. Eng., Oct. 1950).
- J. Bennett Hill and Earl G. Gaylord. Recipients of the first Certificates of Appreciation ever presented by the research committee of the American Petroleum Institute. Win-





M. Souder

H. F. Johnstone

Mott Souders Jr., chief of chemical engineering research for Shell Development Co., and H. Fraser Johnstone, head of chemical engineering at the University of Illinois, have been appointed to the editorial advisory committee for the Chemical Engineering Series of McGraw-Hill texts and reference books. Organized in 1925 under the chairmanship of Dr. H. C. Parmelee, this committee of 14 representative industrialists and educations first recognized the need and laid the groundwork for a coordinated literature in chemical engineering. The series now comprises approximately thirty texts and handbooks, some of which have already gone through three and four editions and have been translated into foreign languages.

Translated into foreign languages.

S. D. Kirkpatrick has succeeded Dr. Parmelee as chairman and consulting editor for the Chemical Engineering Series. Members of the present coramittee in addition to Dr. Souders and Professor Johnstone include Harry A. Curtis, John V. N. Dorr, Arthur W. Hixson, Webster N. Jones, Warren K. Lewis, Albert E. Marshall, Russell S. McBride, Charles M. A. Stine, Edward R. Weidlein, Milton C. Whitaker, Alfred H. White and Walter G. Whitman.

ners are connected with Sun Oil Co. and California Research Corp., respectively.

- Adrien Cambron. Co-director of the Division of chemistry and director of the applied chemistry branch of the National Research Laboratories of Canada; formerly assistant director, applied chemistry branch. Started with the division in 1930.
- Leo Marion. Assistant director, division of chemistry, National Research Laboratories of Canada. Previous positions with the division: head of the organic chemistry section; editor-in-chief, Canadian Journal of Research.
- William B. Dickinson. Member of the organic chemistry staff of the Sterling-Winthrop Research Institute, Rensselaer, N. Y. Graduate of Emory University and the University of Wisconsin (Ph.D., 1950).

- Wayne A. Sisson. New chairman of the ACS division of cellulose chemistry. Section head and rayon research chemist of the American Viscose Corp., Marcus Hook, Pa., since 1940. Formerly connected with the Department of Agriculture and Boyce Thompson Institute for Plant Research, Yonkers, N. Y. Schooling at Roanoke College, Cornell, University of Illinois and the University of Leeds, England.
- W. A. Hooper Huffman. Organic chemist for U. S. Citrus Products Laboratory, Weslaco, Tex., to assist in research on improved processing of fruits and vegetables. Graduate of Mid-Tennessee State College and Vanderbilt University.
- Martin F. Quaely. New member of Westinghouse lamp division's research staff at Bloomfield, N. J. To work on chemical problems connected with the development of rare metals. Studied at Trinity College.
- Fletcher L. Byrom. Superintendent of Koppers Co. tar products division's largest plant at Follansbee, W. Va. Joined Koppers in 1947 as assistant to the production manager. Served on the Research Planning Board of the Navy Department's Bureau of Ordnance. Graduate of Penn State.
- E. L. Oliver Jr. Newly elected vice president of Oliver United Filters, Oakland, Calif. With the company for 17 years, he continues as a director. Graduate of the University of California.
- Paul E. Kuhl. To begin a one-year period as assistant general manager of Esso Standard Oil Co.'s over-all manufacturing operations. Joined Esso in 1926 as a student engineer. Served with development and technical service divisions and as the technical department's assistant superintendent at the Aruba refinery. Other Esso positions: assistant then associate manager of Standard Oil Development's process division; assistant manager then manager of Southern East Coast units; assistant general manager of East Coast manufacturing.
- Frank Bell. Staff sales representative for B. F. Goodrich Chemical Co., Cleveland. Graduate of Case Institute of Technology. Previous positions: chief chemist for the Bolta (Centinued)

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In the brewing of Premium Quality Falstaff, Yesterday and Tomorrow meet. At five great plants — in St. Louis, Omaha, and New Orleans — Falstaff Brewing Corporation combines ancient brewing skills with the most modern brewing methods.

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For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

Sold through leading Distributors everywhere





Co; chemical sales representative of Allied's Barrett Division; technical sales representative for Hycar Chemical Co. then B. F. Goodrich.

O. Q. Lomax. President of Humble Pipe Line Co.; has been assistant general superintendent. Connected with the Humble company since 1918 when he started plans for the Baytown refinery.

Edward Montgomery. Assistant to the executive vice president, Chemical Construction Corp. Retired from the Army in 1949 after 23 years with the Chemical Corps. Technical director in charge of chemical warfare research and development from 1931 to 1935. During World War II he was chemical officer coordinating all chemical warfare work for the Air Force.

William S. Johnson. Chairman of the American Chemical Society's division of organic chemistry for 1951. Professor of chemistry at the University of Wisconsin; joined the staff as an instructor in 1940. Graduate of Amherst and Harvard.

Joseph V. Karabinos. Member of the staff of the National Bureau of Standards' organic chemistry laboratory. To assist in preparation of synthetic carbohydrates for biological and medical research. Previous connections: Chemical Foundation Research associate at the National Institutes of Health; head of the department of chemistry at St. Procopius College; assistant professor of chemistry at the University of San Francisco; National Advisory Committee for Aeronautics investigating the syntheses and properties of aromatic hydrocarbons. Studied at St. Procopius, University of Illinois, Ohio State.

George W. Vinal. Engineering consultant and adviser to the Electric Storage Battery Co. Recently retired chief of the National Bureau of Standards after 42 years with the government. Known for his work in developing electrical standards and the storage battery. Winner of the Electrochemical Society's Acheson Medal. Author of "Storage Batteries."

Bernard M. Blank. Assistant chief



Putting their heads together over our November Materials of Construction report are, left to right, Cecil Chilton, Frank Byrnes and Dick Recves, new CE editors.

## Chemical Engineering Gets Three New Editors

Filling out the ranks of Chemical Engineering's editorial staff are Frank C. Byrnes, Chicago editor, Cecil Chilton, associate editor, and Richard V. Reeves, assistant editor. The last two are located in the New York office.

Cecil Chilton comes to us after a tenyear association with Du Pont. His work has involved process improvement and pilot plant studies, design, economic evaluation. He has been located variously at the company's plants at Niagara Falls, Newburgh, N. Y., Deepwater, N. J. and Edge Moor, Del. Most recently he was research engineer at Newport, Del. He studied at Alabama Polytechnic Institute and Carnegie Tech.

Frank C. Byrnes was a chemistry major, geology minor at the University of Chi-

cago. His first job was with Joseph E. Seagram and Sons in Louisville. He switched to United States Cartridge Co. starting out as mefallurgist supervisor on brass fabrication and annealing and becoming chief chemist. After his release from duties as a Radar specialist in the Navy at the end of World War II, he became plant chemist for General Chemical Co. in sulphuric acid manufacture. He did research on petroleum products for International Harvester and, lastly, he was assistant chemical purchasing agent for Darling & Co.

Darling & Co.

Richard V. Reeves is a 1949 chemistry graduate of St. Peter's, Jersey City, N. J. He went on to Boston University's school of public relations and got his masters in

iournalism.

chemist, Food Research Laboratories, Long Island City, N. Y. Joined the company in 1941. Graduate of New York University.

John T. Edsall. New chairman of the ACS division of biological chemistry. Associate professor of biochemistry at Harvard Medical School. Studied at Cambridge University, England, and Harvard.

Robert P. Bannon. Winner of the A. MacLaren White Award (sponsored by the AIChE) for solution, while an undergraduate, of an engineering contest problem. Shell fellow in chemical engineering at the University of Michigan. Graduate of the University of Illinois.

Harry Wintsch. Assistant to the production manager, Naugatuck chemical division, United States Rubber Co. Formerly production superintendent at the division's plant at Naugatuck, Conn. Veteran of 23 years with U. S. Rubber. Doctorate from the University of Switzerland in Zurich.

James C. Stewart. Transferred from the Atomic Energy Commission's operations office in Schenectady to the new office temporarily located in Wilmington. His new title: director of the engineering, construction and production division. He had been connected with the atomic energy project at Oak Ridge until he came to Schenectady in 1944. J. D. Anderson replaces Stewart as assistant manager at Schenectady. Connected with the Atomic energy project since 1944 at the Manhattan District in Boston, Oak Ridge and Milwaukee. Graduate of Purdue.

Roger J. Williams. This year's winner of the Southwest Award of the American Chemical Society. Director of the University of Texas Biochemical Institute. Discoverer of the growth-promoting vitamin pantothenic acid; pioneer in the development of folic acid as a weapon against pernicious anemia. Graduate of the University of Redlands and of Chicago. Started career as research chemist for the Fleischmann Co.; taught chemistry at the University of Oregon and Oregon State. Came to Texas in 1939.

George E. Shriver. Recipient of a special alumni citation from Western Maryland College in recognition of outstanding achievements and services in the field of research. Head of the new materials department, U. S. Rubber Co.; supervises research on synthetic rubbers, plastics and analytical methods. Joined company in 1935.

George H. Loving. Director of sales of Du Pont's explosives department. Joined Du Pont as a chemist in 1930; special assistant to the director of the explosives department, 1939; regional sales correspondent, 1942; Technical assistant to technical division manager, then assistant director of sales in the explosives department in 1943.

Frederick E. Herstein. Sales representative in northern New Jersey and parts of New York for Glascote Products Inc. Graduate of Polytechnical Institute of Brooklyn, 1936. Active in corrosion resistant chemical equipment field.

Edwin M. Haun. New member of the development department of Monsanto Chemical Co.'s phosphate division; has been a member of the general development department. Graduate of the University of Illinois. Former Monsanto positions: research chemist at the phosphate division's Anniston, Ala., plant; production supervisor at Anniston.

Robert C. Ellman, W. H. Oppelt and J. C. Holtz. New appointments of the lignite branch of the fuel technology division of the U. S. Bureau (Continued)



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it's more than a question of following blueprints. Stainless steel is a difficult alloy to work. It "acts up" during fabrication. In cutting, forming, welding and even in finishing, your fabricator must know how to guard the corrosion resistance and strength of the alloy. His plant must be specially equipped for working with stainless steel. The longer his experience, the more help he'll give you in building vessels that meet your requirements.

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NAMES IN THE NEWS, cont. . .

of Mines laboratory at Grand Forks, N. D. Respectively, they are: acting chief of the coal preparation section, chief of the utilization section, and acting chief of the chemistry and physics section.

Earl K. Fischer. Chief of the organic coatings section of the National Bureau of Standards. Joined the bureau in 1949. Formerly with the Institute of Textile Technology and Interchemical Corp. Studied at the Universities of Southern California, Wisconsin and Chicago. Author of "Colloidal Dispersions".

Harris M. Sullivan. Vice president and director of research and development of Central Scientific Co.; has been assistant director of research since 1944. Previously: metallurgical engineer, Adirondack Foundries and Steel, Inc.; assistant professor in metallurgical engineering, RPI.

William I. Burt. Vice president of AIChE for 1951. Vice president of B. F. Goodrich Chemical Co.; has been superintendent of production of the chemical division, manager of chemical manufacturing division. Joined Goodrich in 1927. Graduate of Ohio State.





W. I. Burt

R. H. Boundy

R. H. Boundy. Director of Dow Chemical Co. Continues as manager of plastics division. Joined Dow in 1926; active in development and production of hydrocarbons and plastics. Graduate of Case School of Applied Science.

Robert A. Harris. Chief improvement engineer in American Car and Foundry Co.'s production. Chemical engineering graduate, Bucknell University; joined ACF in 1938.

James H. Batte. New executive officer, Technical Command, Army Chemical Center, Md. Former Aide at the White House; wartime commander of the 87th (Continued)

## (A Quick Quiz on modern pH advancements)

## Do you know ...



That Beckman pioneered modern glass electrode pH equipment?

Until Beckman pH instruments were developed, glass electrode pH equipment was a cumbersome, complicated laboratory curiosity. It was Beckman that pioneered today's simple, compact, highly accurate and completely dependable glass electrode pH equipment!



That Beckman pioneered virtually every major development in modern glass electrode pH equipment?

Such far-reaching advancements as glass electrodes that can be used at temperatures as high as 130° C, and show negligible deviation even in high temperature-high pH ranges ... glass electrodes that can be used at temperatures as low as -20° C and will withstand repeated freezing ... glass electrodes so strong they can even be used as stirring rods -so abrasion-resistant they readily withstand long service in abrasive slurries ... these and other vital glass electrode advancements were all pioneered by Beckman. Many of those advancements are still available exclusively in Backman equipment!



That Beckman offers the industry's most complete line of glass electrode pH instruments?

Included in the complete Beckman line are instruments specially designed to combine the high precision and wide versatility necessary for advanced research, medical and laboratory applications . . . others that combine maximum simplicity and high accuracy with complete portability for plant and field applications . . . still others that combine maximum simplicity and high accuracy with the plug-in convenience of full AC operation . . . plus completely automatic pH equipment for continuous pH indication, recording and control on large-scale processing applications.





That Beckman also provides the industry's most complete line of modern glass electrodes?

Although glass electrode pH instruments are the most efficient pH equipment obtainable, no glass electrode pH instrument is better than the versatility, accuracy and dependability of the electrode assemblies available for use with it.

Beckman provides the industry's most complete line of glass electrodes for use with Beckman pH instruments—a type of electrode assembly to meet every industrial, research, laboratory and field requirement!



That there are so many money-seving applications for Beckman ptl control that you may be losing important profits unless you make a complete investigation of your operations?

There is pH wherever there's water, water solutions, moist pastes, sludges, slurries or other moisture-containing substances. And wherever there is pH, chances are the operation can be done better . . . with greater uniformity and less waste at lower overall cost . . . by Beckman-controlling the pH of the various processing operations.

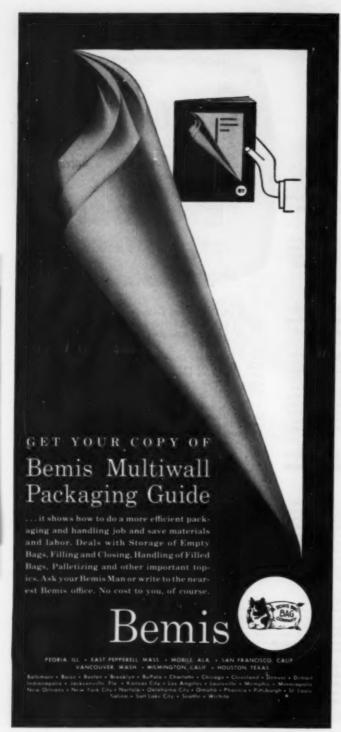
HETHER you manufacture food products or treat sewage ... do metal plating or refine crude oil ... make textiles or process ore —in fact, no matter WHAT your field of operation ... if you have not yet determined whether Beckman pH Control can be used to advantage in your operations —possibly is already BEING used to cut costs by your compessions—let us study your processes and make beligful recommendations. No obligation, of course. BECKMAN INSTRUMENTS INC., SOUTH PASADENA. 14, CALIPORNIA. Factory Service Branches: New York, Chicago, Los Angeles.



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INSTRUMENTS CONTROL MODERN INDUSTRIES

pH Motors and Electrodes — Spectrophotometers — Radioactivity Meters — Special Instruments



NAMES IN THE NEWS, cont. . .

Chemical Mortar Battalion. In 1946 assigned to Operation Crossroads at Bikini. Graduate in chemistry, Davidson College; Master's in business administration, Harvard.

Edwin R. Gilliland. Winner for 1950 of the Celanese Corp. of America Professional Progress Award, presented by AlChE. Professor of chemical engineering at M.I.T.; associate director of the nuclear science and engineering laboratories there. Newly elected director of Dewey and Almy Chemical Co. During World War II: assistant rubber director in charge of research and development. Winner in 1944 of the ACS Backeland Award. Studied at the University of Illinois and M.I.T.





E. R. Gilliland

B. F. Dodge

Barnett F. Dodge. Winner of the 15th William H. Walker Award, sponsored by AlChE. Especially cited for his work on the manufacture of oxygen and his thermodynamic studies. Head of the department of chemical engineering at Yale University. Studied at M.I.T. and Harvard. Before joining Yale faculty in 1925, worked for E. I. du Pont de Nemours and Lewis Recovery Corp. Technical director of Fercleve Corp., Oak Ridge, for a year during the war. Supervised experimental investigations and plant control work in the separation of uranium isotopes.

- R. F. Attner. Manager of valve distributor sales of Manning, Maxwell & Moore, Bridgeport, Conn. Formerly assistant to the sales manager for Hancock valves in Watertown, Conn. Joined the company in 1922.
- T. S. Hodgins. Vice president of Reichhold Chemicals' Pacific Northwest Division. To continue as division manager.

Robert J. Carter. Southwest district manager for Stone & Webster Engineering Corp. Joined the firm in 1939 to work on petroleum projects; has been assistant chief process engineer since 1948. Graduated from Washington University, 1924; spent 15 years doing engineering work in the petroleum industry.

Edward A. Metcalf. Organic chemist in chemical division of Technical Command, Army Chemical Center, Md. Previously, instructor in organic chemistry, Johns Hopkins University.

W. G. Andrews. Assistant vice president of Archer-Daniels-Midland Co. Joined ADM nine years ago as control chemist; has served as research chemist and in the technical service and as director of special oil sales. Graduate of Carleton College and Pitt graduate school.

Raymond W. McNamee. Superintendent of Carbide and Carbon's research and development department; formerly acting superintendent. Connected with the department since 1933. Active in the development of chemicals for agricultural uses.

H. J. Monnik. Project director of Catalytic Construction Co.'s atomic energy division to design uranium ore refinery for New York operations office of AEC. Has been company's chief engineer since 1946.

### **OBITUARIES**

Frederick Bain, 71, deputy chairman of Imperial Chemical Industries, Ltd., died November 15. He had been chairman of the Anglo-American Council on Productivity.

William C. Frishe, 48, professor of chemical engineering at the University of Detroit, died in Detroit November 17. He had also taught at Alabama Polytechnic Institute, Grove City College and Clarkson College.

Charles Englehard, 83, president of Baker and Co. and honorary liffe member of the board of trustees of Stevens Institute of Technology, died in Bernardsville, N. J., December 1.

William Pratt Heath, 75, pioneer chemist in the development of Coco Cola, died in Atlanta, Ga., December 1. A graduate of Georgia Tech. he was a vice president of Coca Cola in charge of quality control until his retirement in 1949.



Why put up with pipe line corrosion when you can stop it cold with PYREX brand DOUBLE-TOUGH glass pipe? In resistance to all acids, except hydrofluoric and phosphoric, it outlasts any other piping material. It is also resistant to mild alkalies. Moreover, it is available now!

Stronger, too! Made DOUBLE-TOUGH by a new heat treating process, the ends of all straight lengths as well as all fittings (except U-bends) are doubly increased in strength. Operating pressures of 50 p.s.i. are within range and in some cases, may be even higher.

Trouble con't hide! The transparency of PYREX brand pipe per-

mits visual check of flow and quality characteristics of any liquid you transfer. Trouble can't hide behind glass. Easy to install and clean, it prevents product contamination.

Available! Stocked by leading pipe engineering distributors, PYREX brand DOUBLE-TOUGH glass pipe is available in 1", 1½", 2", 3", 4" and 6" I.D., including standard fittings. Mail the coupon below for catalog.



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Here's real simplicity in accurate control of flow volume —a single instrument installed in the pipe line, with no connected air or electric circuits. It naturally costs less to buy, and it requires a great deal less attention and maintenance in operation.

The Kates Direct Acting Regulator handles water, oil, acids, syrupa—almost any liquid, in large or small volume, at any practical pressure or temperature. Send for your free copy of Bulletin 552, or tell us your problem and let us recommend a solution.



NEW FACILITIES

Moore Products Co., Philadelphia— A Pittsburgh branch office at 3031 West Liberty Ave. R. H. Owens, formerly sales engineer for the company in northern New Jersey, is manager.

U. S. Rubber Co.—A branch office in Charlotte, N. C., to serve the Carolinas, Georgia, Florida, Tennessee, Alabama and Louisiana. Claude H. Allard has been appointed technical representative.

Tretolite Co.—A new chemical unit at its Webster Groves, Mo., plant to be completed in the spring.

Whiting Corp., Harvey, Ill.—A district sales office in Seattle, Wash. R. E. Florine, district manager, will handle sales of Swenson evaporators, chemical machinery.

Armour Laboratories, Chicago—An international department to supervise manufacturing, marketing and other operations pertaining to Armour pharmaceuticals and allied products sold abroad. New manager is S. B. Bradshaw.

Fabric Research Laboratories, Boston

—A paper division which will offer
research services similar to those
the firm performs for the textile,
plastics and chemical industries.
Geoffrey Broughton will have
charge of the new division.

Innis, Speiden & Co.—A technical service staff for the benefit of users of the company's chemicals, gums, waxes and insecticides.

St. Regis Paper Co.—A \$30 million expansion in its Florida operations including construction of a new plant at Eastport.

H. C. Lang Co., Ltd.—A complete wood preserving plant in Sandersville, Ga. Just opened, the plant will use the Osmose process.

H. K. Porter Co., Pittsburgh—A division to handle manufacture and sale of valves formerly produced at Jarecki Mfg. Co., Erie, Pa.

NEW COMPANIES

Electric Storage Battery International

INDUSTRIAL NOTES

Corp. to carry on the foreign business of the parent company and its subsidiaries. Company will be directed from new offices at 500 Fifth Ave., New York.

Chemical Affiliates, Inc., New York, to trade in chemicals and pharmaceutical products and to develop new markets and new products for chemical manufacturers here and abroad. President is Eugene E. Maneck, recently resigned president and general manager of Brandywine Fiber Products Co.

Detroit Rubber Co., Detroit, to produce molded rubber products, rubber-to-metal assemblies, tank linings, plating rack insulation.

Foster D. Snell de Mexico, Mexico City, to offer consulting, development and engineering services in Central America. J. Carner and J. Sperling are in charge.

Edwal Scientific Products Corp. to market the packaged line of photographic specialties of Edwal Laboratories, Inc.

### **NEW LINES**

Brush Development Co., Cleveland— More surface measuring instruments through the purchase of the Faxfilm Co. The latter has been making a tool which rapidly reproduces in clear plastic an exact reverse replica of a surface.

Cochrane Corp., Philadelphia—Steel heaters, softener and filter shells and numerous weldments. They are all products of Pottstown Metal Products Co., Pottstown, Pa., now a Cochrane subsidiary.

S. Morgan Smith Co., York, Pa.— Butterfly valves through the purchase of R-S Products Corp., Philadelphia. Combined operations of the two companies will permit sales of valves of all sizes.

### **NEW LOCATIONS**

Dorr Co., Stamford, Conn., has moved its eastern sales offices to the general office location at Barry Place in Stamford. A branch office will be continued at the former New York address.

(Continued)

# for VACUUM &



Come to KINNEY for the vacuum pump that's right for your vacuum problem.

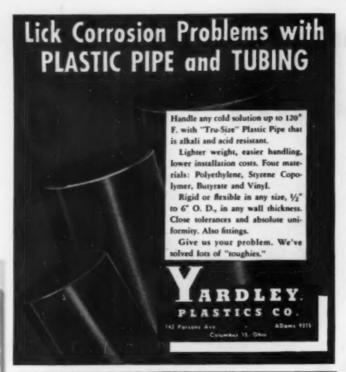
Kinney High Vacuum Pumps range from the big 40 HP unit with 702 cu. ft. per min. displacement to the little 1/3 HP pump rated at 4.9 cu. ft. per min. Kinney offers two basic pump designs — Single Stage and Compound — for low absolute pressures to 10 microns or 0.1 micron, respectively. You can also choose the type of autlet valve that's best for your job — for extremely low pressures, the efficient feather valve, or for air-vapor mixtures, the exclusive stainless steel poppet valve. Return the coupon today for your copy of Bulletin V45 . . . the full story on Kinney's complete line of vacuum pumps. KINNEY MANUFACTURING COMPANY, 3551 Washington St., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle.



Foreign Representatives:

General Engineering Co. (Baddilffe) Ltd., Station Works, Bory Road, Baddilffe, Lancashire Engiand . Herrecks, Roubergh Phy, Ltd., Additional Committee of the Committee of the Management of the Committee of the Committee of the South Africa of the Committee of

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Kinney	KINNEY MANUFACTURING CO. 3551 WASHINGTON ST., BOSTON 30, M Gentlemen:	MASS.			
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INDUSTRIAL NOTES, cont. . .

Synthane Corp. of Oaks, Pa., has moved its New York office to 125 Parkway Rd., Bronxville, N. Y.

B. F. Goodrich Co., Akron, has moved its San Francisco district office to 1950 Army St.

Alan Porter Lee, Inc., has moved its New York offices to 81 Miller Rd., Morristown, N. J.

National Lead Co. will move the general offices of its Baroid Sales Division from Los Angeles to Houston, probably in July.

Laclede-Christy Co. has moved its executive, fiscal and operations of-fices to 310 South Michigan Ave., Chicago.

### **NEW REPRESENTATIVES**

Johnson Corp., Three Rivers, Mich., has appointed Thermal Industrial Engineering Co. of Denver, Colo., as new district representatives, to handle its boiler room equipment.

American Cyanamid Co., New York, has announced that the products of its industrial chemicals division and coating resins department will be distributed throughout Canada by its subsidiary, North American Cyanamid Ltd.

Dampney Co. of America, Boston, manufacturer of protective coatings for metal, has appointed Allied Services, Inc., Charleston, as sales and service representative for southern West Virginia.

Columbia Cellulose Co. Ltd. has appointed Bulkley, Dunton Pulp Co. selling agent for the market pulp of its plant near Prince Rupert, B. C.

Roots-Connersville, Ind., has appointed the Koerner Engineering & Supply Co., Portland, Ore., exclusive sales agents in the states of Oregon and Washington. Company's products include rotary positive and centrifugal blowers and exhausters, cycloidal vacuum pumps, positive displacement meters and inert gas generators.

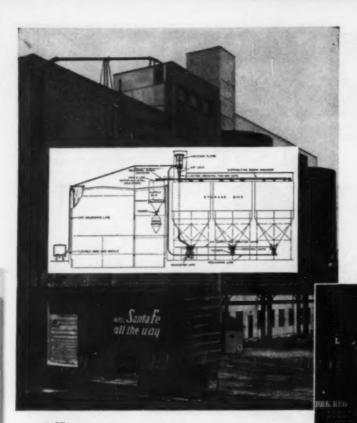
Tube Turns, Inc., Louisville, Ky., has appointed Bethlehem Supply Co., Tulsa, Okla., and Bethlehem Supply Co. of California, Los Angeles, as distributors of its welding fittings and flanges.

—End

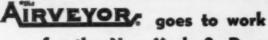


ERIEZ MANUFACTURING CO, ERIE, PA., US.A. PRODUCERS OF MAGNETIC SEPARATORS
AND SELLERS OF (60) ELECTRONIC METAL DETECTORS





if it's pulverized, convey it pneumatically



## for the New York & Pennsylvania Company

Problem: To install a conveying system for coating clay that would match the efficiency of the expanded and modernized plant at Lock Haven.

Solution: Pulverized coating clay, with a moisture content of not over 3 per cent, is pneumatically unloaded from box cars and conveyed to the Airveyor filter for delivery to any one of three storage bins, or direct to a supply bin above a weigh hopper. Unloading rate is 10 tons an hour. The same system reclaims clay from the storage bins and delivers it to the supply bin—by remote control from a centrally located panel board. Provision is made for automatic return of clay to the storage bin, from which it is being conveyed, when the supply bin is full, or to any bin in any sequence when unloading from cars.

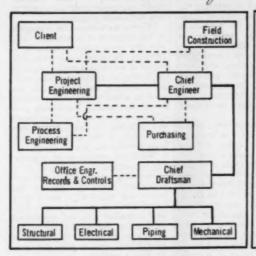
If handling of dry, pulverized materials is a major problem to you, look to Fuller for the most economical and practical solution. Fuller specializes in pneumatic methods of materials handling. Today, the Airveyor, and other Fuller Systems, are cutting handling costs, and materially increasing operating efficiency in hundreds of installations. To have a Fuller Engineer survey your present system and make recommendations for modifications places you under no obligation whatever. It's more than likely that the results of his study will point your way to more efficient materials handling at lower operating and maintenance costs.

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DRY MATERIAL CONVEYING SYSTEMS AND COOLERS— COMPRESSORS AND VACUUM PUMPS— FEEDERS AND ASSOCIATED EQUIPMENT

## Quotes, Extracts and Digests Edited by Morgan M. Hoover & Richard V. Reeves



#### PROCESS DEPARTMENT ORGANIZATION Process or Project Engineer - L. Prepare fundamental process. Approve or furnish design, Serves as over-all coordinator (7-10 years experience) between client, field, process and engineering. Senior Chemical Engineer 1. Serves as group leader. Assists process engineer in (3-5 years experience) the preparation of final process design. 3. Summarizes routine work for process engineers' approval or comment. - 1. Performs detailed material Junior Chemical Engineer balance and heat balance (Usually 1-2 years calculations. 2. Performs any routine jobs reprevious experience in operations) quired in design.

## Opportunities in Design

If you're a young engineer thinking of going into design work, you naturally want to know something about the future you're headed for, how fast you can expect to get there, and what the qualifications are.

#### W. M. HATHAWAY

Job opportunities in design open to chemical engineers can best be pointed out by outlining the steps required in the handling of a complete chemical engineering project from its inception to initial operations.

Preparation of the fundamental process involves the use of all of the Many economic unit operations. studies must be made between the preliminary design and the final process design. Detailed calculations must be made to develop the required reflux ratios or oil rates on the fractionators and absorbers. All of the necessary equilibria and enthalpy data must be obtained for the process. Once the fundamental process flow sheet is developed, the project engineer can divide the detailed calculation work required for the material and heat balance for the entire plant among the senior and junior chemical engineers.

As these balances are completed, the equipment may be sized—and equipment specifications written with the cooperation of the engineering department and transmitted to the purchasing department for obtaining quotations from vendors.

It is the duty of the project engineer to supervise the selection for purchase of the proper equipment which best suits the job it is to perform. Usually the chemical engineer will evaluate the bids with the cooperation of the engineering and purchasing department and submit a summary and recommendation for the project engineer's approval.

As the engineering progresses the chemical engineer is often called upon to consider last minute process changes and to make necessary revisions. Frequently revisions cannot be made because of the delay in construction or the high cost of changing equipment which may already be fabricated.

As the engineering is completed it should be given a process check by the process department. Some checking by the chemical engineer should also be made in the field as construction progresses. These checks are made to be sure that the installation and layout of the equipment will not interfere with the process.

When the plant is finally completed, the chemical engineer is usually called upon to assist in starting up initial operations of the unit, in which the performance of the equipment is thoroughly tested.

The project engineer serves as the over-all coordinator between process, engineering administration, client, and the field. In the process design section the chemical engineer is frequently in fairly close contact with the other branches of engineering (mechanical, civil and electrical) since the final physical design of the unit is prepared by these engineering groups. The process engineer furnishes the fundamental data for engineering department to prepare the mechanical design and drawings.

This information is transmitted through the project engineer to the engineering department where it is given to the proper section for incorporation in the plant design. The completed engineering drawings must be checked by the process department before final approval is given for release to the field for construction.

The process engineer prepares the fundamental process flowsheet and furnishes or approves all data or meth(Continued)

ods used in the process design of the plant. A chemical engineer becomes a process engineer only after 5-10 years of experience in the field of process operations and design. It is preferable for a chemical engineer to have some experience in actual operation of a plant in order to familiarize himself with various types of equipment, how they operate, and pitfalls to watch for in design of such equipment.

Once the fundamental process flowsheet is set up preliminarily, the senior chemical engineers can assist the project or process engineer in carrying out the necessary design studies in order to arrive at the most practical and economical final process flowsheet. The junior chemical engineers will probably carry out the majority of the routine calculations, tabulations, and other minor tasks necessary to complete these studies.

Always bear in mind that process design work is not all glamor—a majority of the time is spent in tedious calculations or routine checking and evaluation work. Naturally, the brunt of the routine work will fall to the least experienced men on the staff, the junior chemical engineers.

Fundamentally, it is the dollar sign which always controls the final design. However an engineer must be able to use sound judgment in selecting the optimum method or piece of equipment for performing the function in question. Optimum design is not based on minimum capital cost alone, it is based on minimum over-all operating costs which include the effect of maintenance, efficiency and down time of the plant. Experience is an invaluable factor in selecting equipment and methods which result in the optimum design.

Some of the characteristics which might be of importance in becoming a successful process design engineer are: (1) Must be practical and level headed, (2) Must be aware of the importance of the dollar in over-all operating cost, (3) Must be able to handle routine work, and (4) Must be able to cooperate with other engineers.

How long does it take to get somewhere? A junior chemical engineer may become a senior chemical engineer in three to five years. A senior chemical engineer serves as a group leader, in other words directs the activities of several junior engineers. Usually a senior engineer becomes a process or project engineer after 7 to 10 years of experience. In our organization the average experience of project engineers is approximately 10 years. Circumstances and opportunity play a part in how fast a man progresses.

What is the future as far as progress in the company is concerned? The next step above project engineering is company administration. It seems only logical to assume that project engineering is excellent training for filling executive positions and the chances are good for advancement when a vacancy occurs. In chemical engineering projects the majority of project engineers will probably be chemical engineers particularly if the engineering company provides the process design.

While job security in an engineering organization is not as good as in an operating company, the salary level is probably somewhat higher for this reason and the work is much more varied in nature. A good process engineer is familiar with, and experienced in operation, design, and construction of process units. For this reason it takes several years to adequately train for such a position.

W. M. Hathaway, Wyatt C. Hedrick Engineering Corp., before the Fifth Annual Technical Session, American Institute of Chemical Engineers, Galveston, Tex., Oct. 27, 1956.

## Opportunities for Engineers to Share in Management's Social Responsibilities

BLYTHE M. REYNOLDS

We are still in the experimental stage as to the best way to handle human relations. However, some fundamentals have been established that are as important in human relations as are the laws of science in engineering matters. First, and foremost, our decisions should conform with the golden rule. A corollary follows: we must give importance and dignity to the individual and recognize his equality, and at the same time, the uniqueness of each. You have but to search your own memory to find cases where greed and inconsideration for the other fellow have boomeranged. In Nazi Germany and Communist Russia, the uniqueness of the individual is not recognized. This probably represents the greatest difference between their society and ours.

Fundamentally, we're all very much the same. We have the same fears and the same desires. On judgment day, we will, undoubtedly, all be given equal consideration. It is well to



Blythe M. Reynolds is vice president for engineering and purchasing of Merck & Co., Inc.

absorb this philosophy for its sobering, humbling value and improving our tolerances towards our associates. There appears to be a contradiction in the saying that we must, at the same time, recognize the uniqueness of the individual. There is no real conflict, for by uniqueness we mean that each individual has capabilities peculiar to himself; that each has a right to develop his own life, and that each of us interprets the facts on the basis of our own experience.

Once we accept the concept of the individual as unique, we recognize that an organization should be built on mutual respect between individuals in different grades, that a company is like a team where every individual plays his part, that an individual's pay is secondary to the respect which he receives. Everyone should be made to feel that his participation is important, for it is. It is this same concept that makes it important for us as engineers to recognize our opportunities and responsibilities to share in the solving of management's problem in this field.

Capable men are industry's principal asset. The ability of a company

(Continued)



## "high-light" Kreelon is sales-tested

What do we mean "sales-tested"?
Just this. Before Wyandotte "high-light"
Kreelon " leaves our plant, it is given
a 3-way detergency test. We not only test
Kreelon on an "as-is" basis, but also
as a "built" product. We test Kreelon not
only for soil removal and whiteness
retention, but also for promotability with
Carbose (Sodium CMC).

Result? When you buy Kreelon, you get a product that you know will perform — built or unbuilt. You get a product that's white in color — clear in solution. Yes, you get a product that keeps its foot in customers' doors.

Rog. U. S. Pat. Of

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to produce leaders is more important than its ability to produce saleable products efficiently. The rate of industrial expansion is limited by industry's ability to train leaders. These are astounding facts little recognized until recently. One proof lies in the value of a company as a going concern, compared with the value to be realized from the sale of its physical assets separately. The latter would normally be but a fraction of the former.

Once we recognize that the major problem of industry is to train leaders, we immediately face the question of an adequate criteria of leadership ability. It is here that the engineer faces a real challenge. It is not only a yardstick for leadership ability that we need, but an adequate measure for any individual's productivity. It is essential that the people in an organization believe in equal opportunities with reward of merit and that the management have the respect of the workers. We do our best to use rational and reasonable methods of judging an individual's capability and productivity, but our final decisions are too dependent on the personal opinion of a superior to be beyond question. A yardstick of individual productivity, based on scientific methods, is the number one problem in discharging management's social responsibility. Charles E. Wilson, President of General Electric Co., has his engineers working on this problem and considers the determination of a criteria of work acceptable to labor and management as the most promising method of settling industrial strife. To get a taste of the problem, try to think of a suitable method of measuring your own productivity.

If we, as engineers, are going to really tackle these problems in human relations, maybe we should take a trial balance of our individual qualifications. Overstreet's book "The Mature Mind" presents a new concept of maturity. There are very few adults whose minds have matured in ratio to their physical maturity. A criterion of the mature individual is "one whose mental habits are such that he grows in knowledge and the wise use of it."

We as part of management have power to influence the lives of other people, by our decisions and by our votes. This power carries with it a responsibility to exercise it intelligently. We cannot limit our growth to our profession. We must improve our knowledge and the wise use of it in all fields where we have power, in the education of our children, in the exercise of our franchise, and in management's human problems. If we fail



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to develop the proper mental habits to do this, we are immature. It is not the mastery of facts, but one's attitude towards knowing what determines maturity. Human misbehaviors are immature ways of solving problems. Criminals are immature people. Immaturity may have been fostered by previous fixed concepts, possibly by frustration in youth. One should recognize his own problems and strive for maturity in his mental attitude. Life should never be a settling down into making a living. It should be stimu-lating and satisfying. The broader your interests, the more you are involved in service to others, the nearer you will approach maturity.

There is no doubt that all of us have a lot of untapped capabilities that we or no one else recognizes. If we can broaden our perspective to recognize our abilities and our opportunities, we may be of untold service to mankind. Probably some of you have read Russell H. Conwell's "Acres of Dia-monds." The theme of his sermon The theme of his sermon was simply that there are the equivalent to acres of diamonds right where we are, in the job we are in, if we will only permit ourselves to see our opportunities. He tells story after story of individuals who gave up in disgust, went elsewhere and someone else took over their place and found untold riches there of one kind or another.

He tells of the farmer near Titusville, Pa., who was dissatisfied with his lot and went to Canada in search of oil. The man who bought his farm noticed a scum of oil behind a log floating on a pond on the place. From this observation, a source of oil was discovered and the new owner became wealthy. He tells of the mining en-gineer who was teaching in New Hampshire, became dissatisfied and went West to enter the mining busi-ness. The purchaser of his home in New Hampshire noticed a bright metal in a stone in the gate post at the entrance. From this observation, a rich silver mine was discovered on the property. Let's look for the acres of diamonds in our own individual positions in life.

We can summarize the philosophy expressed above by saying: Engineers in industry are part of management and should share in management's social responsibilities. These responsibilities imply power to influence the lives of other people. We must equip ourselves to use this power intelligently.

These social responsibilities are broad, covering society at large, our immediate community and human relation problems within the company. The free enterprise system and our way of life can be preserved only by (Continued) JUST TURN IT

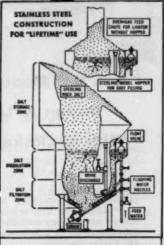
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QED, cont. . .

the intelligent, aggressive attack of these problems.

In fulfilling such obligations we have opportunities to live fuller, more useful and satisfying lives. We should grow in knowledge and the wise use of it. We should try to broaden our perspective to recognize the opportunities in our immediate position in life.

Blythe M. Reynolds, Merck & Co., before the New Jersey Section, American Institute of Chemical Engineers, Sept. 19, 1950.

## AEC REACTOR PROGRAM

### . . . Problems and Progress

Lawrence R. Hafstad

Nuclear reactors are the machines for converting the energy available from the chain reaction into useful forms. Most dramatically, perhaps, the reactor is a slowed down and controlled atom bomb explosion.

trolled atom bomb explosion.

The technical problems are many.

Some of them include:

I. Materials to stand higher temperatures than are attainable from chemical reactions.

 Materials which show minimum radiation damage under the intense bombardment of neutrons, gammarays, etc., in the interior of the reactor.

3. Materials which do not absorb and waste an excessive proportion of

the available neutrons.

Shielding of personnel and instruments against the adverse effects of radiation.
 Control gear with response times

adequate for safety.

Heat transfer rates higher by an order of magnitude than those conventionally used.

 The control of radioactive materials produced in the fission process and deposited with the fuel elements to the detriment of the neutron economy.

 The handling and ultimate disposal of radioactive wastes in a manner which will constitute the minimum health hazard.

The second major phase of the current reactor program is specific reactor projects. These are four in number:

A materials testing reactor, designed for the highest neutron flux yet attempted. As its name indicates, it will be used in the development of other reactors. Construction well advanced.

2. A ship propulsion reactor which is to be a land-based prototype of a

#### MOVE OVER HENRY!

"Chemicals must now be considered the premier industry of the United States . . for the first half of the century the title was held by the Automobile Industry . . . But as of now, the Chemical Industry cannot be matched by any other in dynamics, growth, earnings, and potential for the future."

FORTUNE MAGAZINE

reactor for propelling submarines, is being designed to operate in the slow neutron energy range with which we have had extensive experience. Construction is well under way.

3. An experimental breeder reactor designed primarily to explore the possibilities of breeding, that is, produc-ing more fissionable material than is consumed. This reactor will operate in the high energy, or fast neutron energy range. We have one other reactor operating in this range. Construction and fabrication is practically complete and installation is beginning.

4. A ship propulsion reactor designed to operate in the intermediate neutron energy range, in which we have had no experience. This project, basically a power reactor, replaces an earlier project for an intermediate reactor for both power and breedingnow in advanced stages of engineering design.

Lawrence R. Hafstad, Atomic Energy Commission, before the American Petro-leum Institute, Los Angeles, Nov. 16, 1950.

#### ULTRASONIC ENERGY

#### . . . In Industrial Processes

John W. Butterworth

The barrier to the use of ultrasonic energy in industrial processes has been overcome by a new technique developed by the Brush Development Co. in building an experimental, or pilot plant, 2 kw. ultrasonic generator. Generators of unlimited power can be built as a result of the development of a ceramic material which gives off high frequency, high intensity sound waves when excited electrically.

Some of the unique effects of ultrasonic energy, or sound which is too high in pitch to be heard by human ears, have been known for nearly 30 years, but have been limited in their industrial applications by a lack of the necessary power. One application of these effects is in the killing of bacteria in vaccines and other pharmaceu-tical products. This method promises to be superior to sterilization processes using either heat or chemicals. (Continued)



#### You save many ways . . .

Here's how Industrial filters keep down filtration costs - The flow rates of Industrial filters are based on the solutions involved. You know the capacity you get. With Industrial you get an adequate filter with slurry tank, motor driven pump, valves and fittings in a complete package with one, undivided, experienced responsibility—with space requirements at a minimum.

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The engineering, design, and construction of Industrial filters have proved out in long service and low maintenance costs. Industrial has the experience and is large enough to handle your filter requirements. Since 1927 filters and filtration systems have been an important part of our business.

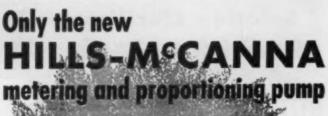
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"Seventy-two percent of the American people have a favorable impression of the oil industry."

DR. GEORGE GALLUP, Director Opinion Research Institute

QED, cont. . .

For example, penicillin would have its effectiveness reduced greatly if it were sterilized by heating. Since it is frequently injected into the human blood stream, it is very difficult to add a chemical which would kill the bacteria and not be harmful to the human body. Another use of sonic energy is in preparing emulsions of liquids or solids in order to prevent settling or separation. An instance of this application is the irradiation of paint by ultrasonic energy. When this is done, the pigment, or coloring matter, in the paint no longer settles out from the oil vehicle.

While this generator is an experimental model for pilot plant operations, it demonstrates that units of almost unlimited size can be constructed.

John W. Butterworth, Brush Development Co., before the American Institute of Chemical Engineers, Columbus, Dec. 6, 1350.

#### STEEL

#### . . . Harder Stainless

Stainless steel, never noted for its hardness, can be made 100 percent harder by working the metal at sub-zero temperatures (down to -300 deg. F.).

During the course of fundamental investigations of cast stainless steels of Crane Co. laboratories, impact tests were conducted at the temperature of liquid nitrogen (about -300 deg. F.). After the tests had been completed, one of the samples, which had returned to room temperature, exhibited a strong magnetic effect near the fracture. Other samples broken at room temperature showed none of this magnetism. Subsequent tests showed that temperature alone was not a factor. Apparently the increase in permeability had been caused by a combination of the severe plastic deformation-caused by the impact tests-and the low temperature.

When steel is either heated or cooled certain changes in its crystal structure may take place. In cooling to sub-zero temperatures, stainless steel can be made to change from the gamma to the alpha state, and

#### ... WHATSAMATTER CHEMICALS?

"Through the ages mention of chemistry has brought to mind foul odors, polluted streams, explosions and corrosive action." WILLIAM RAND, President Monsanto Chemical Co.

this transformation brings about various changes in physical characteristics. Magnetic permeability is but one property affected.

To research engineers this hinted that other improved properties could be expected by working the metal at low temperatures. Tests confirmed this. Adjacent to the fracture, hardness had increased over that in the "as-cast" condition by some two to three times (to approximately 400 V.P.N.).

Effects of rolling and drawing at sub-zero temperature were investigated. Combinations of preparatory heat treatment, sub-zero working, and subsequent high temperature aging were tried. Some of the best results were obtained by a short period of heat treatment at about 2100 deg. F.; quenching in water; cooling to about -300 deg. F.; rolling the metal while at that temperature from 1 in. down to to in.; and then aging for several hours at about 750 deg. F. The results were better than obtainable by low-temperature rolling alone, by preparatory heat treatment alone, or by any combination of these processes. Significantly, the highest hardness and strength values were obtained in those specimens rolled at the lowest temperature. Tensile strength, yield stress and hardness were all increased by this process as compared to conventional rolling. Of particular interest was the increase in proportional limit, which proved to be more than double that obtained by rolling at room temperature. Torsional yield stress and fatigue strength was also increased by about one half.

One sample tested showed an even more remarkable characteristic. Austenitic stainless steels worked by conventional methods have a very low wear resistance, as compared to the best wear-resistant metals, such as certain of the cobalt-chromium base alloys that are frequently used because of their excellent resistance to wear under sliding friction. Yet one of the specially processed stainless steel specimens, differing slightly in composition from the others, showed a wear performance equal to or better than the best wear-resistant metal combinations. Although this characteristic did not show up in other samples to as great a degree, the possi-(Continued)

Silica—Millions of Tons!

Outstanding among its great variety of mineral resources readily available for chemical manufacturing is Oklahoma's tremendous reserve of high grade silica, in several forms:

Glass Sand. Equal in chemical quality to any in the United States and used by glass plants in Oklahoma and adjacent states since 1913.

Tripoli. This state has long been an important supplier of tripoli, in 1944 ranking third in national production.

Novaculite. Outcroppings of more than 100 square miles in southeastern Oklahoma are a continuation of the outcrops in southwestern

Arkansas where novaculite has been produced for many years and where chemical analysis shows silica content to be 99% or more.

Vein Quartz. Very large deposits of milky variety are easily accessible.

Chat and Slimes. Millions of tons of highly silicious material are available as by-products of zinc mining in northeastern Oklahoma. TYPICAL ANALYSIS OF SILICA GLASS SAND FROM ARBUCKLE MOUNTAINS

Average of Plant Res — 194
510: 99.829
Fe<sub>2</sub>O<sub>3</sub> 0.036
A1<sub>1</sub>O<sub>3</sub> 0.072
CaO 0.009
MgO 0.003
L. O. I. 0.072

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.





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QED, cont. . .

bility exists that these unusual results can be reproduced consistently.

From Westinghouse Electric Corp. Technical Bulletin No. A-50532.

#### **EXCESS PROFITS TAX**

#### . . . Reasons Agin It

Bradley Dewey

Profits should be taxed out of war by renegotiation and not by a form of excess profits tax that promotes extravagance and waste and destroys incentive.

Earnings resulting from natural, planned growth of businesses not a part of the present rearmament program should not be subjected to an excess profits tax such as the one now being considered.

While in the present situation a pay as we go tax policy is desirable, it is even more important that we keep efficient and healthy both new projects and the older enterprises within existing businesses.

As an example, many younger men who fought in World War II, have helped build businesses and parts of businesses which are now just turning the corner and should not be crippled by an excess profits tax which becomes a tax on healthy growth.

The proposed tax would lead to many forms of indiscriminate and unnecessary expenditures by business and industry on the theory that the money would go for taxes in any event. There would be no encouragement of the incentive to start new businesses if the earnings were to be treated as excess and taxed away. Such incentive is essential today to expand production of many basic products already in short supply and which the country must have in the event of sudden, allout war.

Bradley Dewey, Dewey and Almy Chemleal Co., before the House Ways and Means Committee, Washington, Nov. 1, 1950.

#### CHROMIC ANHYDRIDE

#### . . New Acid Process

The conventional process for the production from chromite ore of chromates and compounds derived from them is by roasting with alkali in the presence of air. Drawback is that the process is economically sound only for high-grade ores. Now a process has been evolved which operates with lower grade ores and gives as the primary product chromic anhydride which is more useful than chromates.

#### MEAT AND POTATOES

"Of the total annual sales of Swift and Co., I would guess somewhere around \$100 million comes from products that fall into the general category of chemicals."

E. A. Moss, Vice President Swift & Co.

Process consists essentially of the

following steps:

1. Chromite ore, ground to -200 mesh, is digested in three times the stoichiometric amount of 75 percent sulphuric acid at a temperature from 140 deg. C. to 160 deg. C., with chromic anhydride (10 percent of the weight of the ore) added as catalyst. The reaction is exothermic and the digestion period is 4 hr. for 90 percent solution of the ore.

Resulant liquor, or "green liquor" as it is termed, is diluted and filtered to remove small quantities of undi-

gested chromite and silica.

3. Filtered green liquor is further diluted to a concentration of 45 g. Cr<sub>2</sub>0<sub>2</sub> per l. and the chromic sulphate electrolytically oxidized to chromic acid in diaphragm-type cells with a current density of 20 amp. per ft.º on lead peroxide anodes. Oxidation is allowed to proceed until the resulting "red liquor" is 95 percent oxidized, when the over-all current efficiency is from 50 to 55 percent.

4. Red liquor is evaporated until the sulphate ion concentration is 750 g. per l., cooled to room temperature and stirred for 12 hr. to allow crystallization of ferric and aluminum sul-

5. The resulting slurry is filtered and the sulphate cake washed with a 60 percent solution of sulphuric acid saturated with ferric and aluminum sulphates, to displace occluded mother liquor. Separations of from 85 to 90 percent of the ferric sulphate and from 60 to 80 percent of the aluminum sulphate are achieved, with less than 5 percent chromic anhydride loss.

6. The filtered red liquor is evaporated until its normal boiling point reaches a temperature of approxi-mately 150 deg. C. and cooled to room temperature when chromic an-

hydride crystallizes.

7. The concentrated liquor is filtered and a 90 percent yield of the chromic anhydride in the filtered red liquor is achieved. The product is 90 percent pure, but this may be increased to 95 percent (99 percent on a dry basis) by washing with a fine water

8. The filtered mother liquor, which is recycled for the digestion which (Continued)

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There's one best extinguisher to guard any fire hazard. Call on your local Pyrene\* jobber for the right Pyrenes for your hazards. Pyrene makes extinguishers for every fire hazard; jobbers carry various types in stock. That means you get immediate delivery, pay no freight charges from the factory. One invoice handles everything. And you deal with an established business right in your community.

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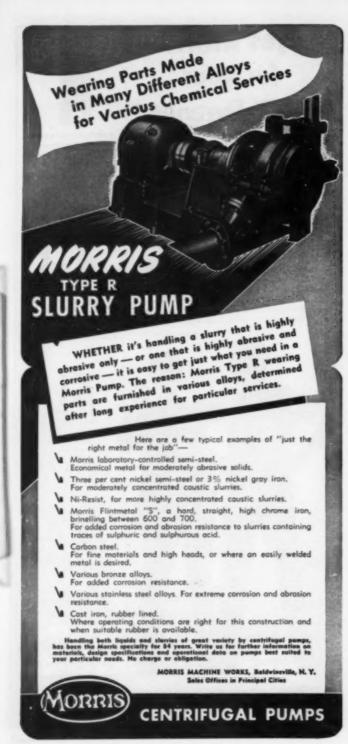
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follows, contains sufficient chromic anhydride to serve as catalyst and a substantial portion of the sulphuric acid required.

The process is thus essentially cyclic, and constant conditions are reached with respect to all components except magnesium sulphate, the concentration of which increases with each cycle. However, it has been shown from pilot-plant studies that the process may be operated for at least 12 cycles with high grade ores and 4 cycles with low-grade ores. A yield of approximately 75 percent of the available chromic anhydride in the ore was obtained from pilot-plant tests.

J. Soc. Chem. Ind., 69; 275 (1950).

#### PAPER

#### . . . From Sericea

Maurice E. Barker

A new source of paper has been found in a plant which can be grown from Virginia to Kansas and which stops erosion and improves the soil.

The stalks of the plant, which is called Scricea, can be processed to make paper that can compete with paper from wood pulp both in quality and cost of production.

Sericea can be made into building board which is a product superior to any on the market. It can also be made into rayon and other cellulose products and, in addition, Sericea seeds produce cooking oils and the leaves yield tannin for the leather industry.

In the Ozarks of Arkansas there are almost as many abandoned farm homes in some sections as there are occupied farms. By coupling this fact with an awareness that the U. S. today is using paper materials faster than they are being replaced, and that nearly 1 million tons of paper and pulp are being imported every month, it is hoped that we can solve the problem of domestic paper supply and create an economic use for millions of acres of nearly useless land.

Taking into consideration also the fact that large areas of sub-marginal land, in the very country where Sericea grows best, are in dire need of erosion control and soil restoration, Humboldt, Tenn., and Fayetteville, Ark., were cited as good places to build two paper plants with a capacity of about 250 tons a day, each to utilize soil-building, cash-producing Sericea with great benefit to the country as a whole and to the community in particular. Such a factory would cost \$10 to 12

million to build. Raw materials for such a plant could be supplied by Sericea grown on 20 percent of the land within a 25-mile radius, and it would be profitable to haul the stalks up to 30 miles by truck to the factory.

An acre of land planted with Sericea would, after the second year, produce about a ton of pulp, or an income from the stalks alone of about \$30. More than this, it would yield about 500 lb. of seeds for sale, 40 percent of which can be used as the basis for edible oils. The Sericea would also improve the land by fixing nitrogen and would stop erosion completely. About 100 lb. of tannin could be extracted from the leaves also, but whether this would be a profitable process has not been established. The North Carolina State College is now working on this phase of the problem.

With regard to use of the product, the rayon we have been able to make from this material is as good as that produced from first-cut cotton linters.

On the other hand, the small fibers of the Sericea make up into paper that is relatively weak. It is of great advantage, for this reason, to grow about 15 percent of a second kind of Sericea plant, called Lespedeza Bicolor, which has a long fiber and produces a full-bodied paper when combined in this ration with the Sericea. In addition, the Bicolor yields a bumper crop of rich seeds, and, if planted around the edges of woods and along stream banks, attracts a good supply of game birds which control insects.

Sericea is a possible source of cellulose products on a large scale through the middle tier of states from Virginia to Kansas. It can compete with wood both with regard to quality of product and cost per ton of product.

Maurice E. Barker, University of Arkansas, before the Sixth Southwest Regional Meeting, American Chemical Society, San Antonio, Dec. 9, 1950.

#### EDUCATION

. . . Johnny and the three R's

Fred D. Fagg, Jr.

American business enterprise depends greatly on the productive use of machinery and tools, but, most of all it depends on men. Its success or lack of success, depends on the quality of men who compose its management, on its ability to work with the men who make up its labor force, and on its ability to persuade other men to buy its product. The prime function of education is to improve the qualities of the men who will con-(Continued)



Even the split-micron dust particle will not penetrate the microscopic pores of the cylindrical bag of special felt in a MIKRO-COLLECTOR.\*

Moreover, the bag is kept constantly clean by the Hersey automatic, reverse-jet cleaning ring which flexes the bag while moving up and down its outer surface—thus assuring free airflow, phenomenal filter rates and far higher capacity per given area of filter fabric.

Put these two features together and you have the reason why a MIKRO-COLLECTOR not only TURNS YOUR DUST INTO DOLLARS but stops those many dollar losses due to inadequate dust control.

> SEND FOR actual sample of felt that makes the MIKRO-COLLECTOR so outstanding . . . also case histories revealing dollar and cents savings through its use.

\*Patents applied for by H. J. Hersey, Jr., and Pulverlzing Machinery Company.

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tribute to management, to production, and to the other activities carried on by the good citizen.

Businessmen, therefore, are interested in what and how we teach. Every so often some group rises up to ask whether the schools are teaching the "three R's"-or whether, perchance, they are letting the young-sters bypass the essentials in favor of

the more interesting.

Papa and Mamma have always wanted Johnny to take something "practical." If he intends business as a career, they wanted him to take nothing but those subjects found in a commerce school course. In my opinion, however, such a program might furnish specific training for an immediate job, but it would not make Johnny the kind of a man you, as an employer, want to obtain from a university, nor would it make him the kind of a citizen that this world needs.

I have therefore, explained to Johnny's parents the sort of questions you businessmen ask us when you are looking at our graduates. Some people may be surprised to know that you don't start out by asking us what grades a student makes. Instead, you ask the more basic, human questions.

1. What kind of a person is he? In particular: (a) Is he the sort of person who wears well? (b) Is he honest? (c) Can he say No? (d) Does he have a sense of humor? (e) What does he do with his spare time? (f) Does he check his daily conduct by a discriminating set of values?

2. Is he a team-worker? That is:
(a) Does he work well with other people? (b) Is he fair and objective in his approach? (e) Can he listen? (d) Is he satisfied with his share of the credit?

3. Is he a self-starter? Specifically: (a) Is he willing to assume responsibility? (b) Is he resourceful or will he seek help at all stages of an undertaking? (c) Will he complete the job-even if he encounters real difficulty? (d) Does he possess intellec-tual curiosity of a high order?

4. How able is he? For example: (a) Does he know how to analyze a problem and how to gather the material which is necessary for its solution? (b) Can he present his conclusions clearly, concisely, and persuasively—both orally and in writing? (c) What grades did he find it possible and worthwhile to make in his courses of study? (d) What "difficult" courses did he take that were not required?

5. What does he know? (a) About man? (b) About his environment? (c) About the history of ideas-in-



Industrial Filler Media for over Forty You

cluding the history of those ideas as expressed and experienced in governmental patterns and in economic systems? (d) About man's creative endeavors in art, literature, and music? (e) What "useless" knowledge (the kind that pays off in satisfaction rather than in dollars) has he acquired?

These are the things I find that you businessmen want to know about our graduates, and when Johnny's parents realize that your questions are not only natural and proper, but that they raise the fundamental issues involved in any educational process, they gradually come to see that in many cases the so-called "theoretical" courses we offer are, in reality, the most valuable throughout a lifetime and, paradoxically enough, are the most "practical."

Fred D. Fagg, President University of Southern California, before the American Petroleum Institute, Los Angeles, Nov. 16, 1950.

#### TARTARIC ACID

#### . . . New Synthetic Process

J. M. Church and Ruth Blumberg

Synthetic tartaric acid promises to make the manufacture of baking powder independent of foreign sources of supply.

Readily available raw materials are used in the synthetic process which is considerably simpler than the slow and complicated recovery of natural tartaric acid as a byproduct of the

wine industry.

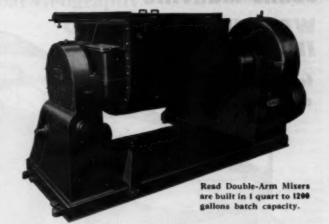
Because of its similarity to tartaric acid in general structure, a compound called maleic anhydride, which is readily obtainable from the coal-tar product benzene, was selected as the starting material for the synthesis. Combined with hydrogen peroxide in the presence of a small amount of oxide of tungsten acting as a catalyst, a water solution of maleic anhydride gave good yields of tartaric acid with little or no impurities. Recovery of the product from the reaction solution is easily accomplished by a simple crystallization, yielding a high quality product directly.

Although the cost of the synthetic tartaric acid by this process is slightly higher than current prices from abroad, it represents a superior product in quality and is independent of any importations or connections with non-chemical industries. Furthermore, the process offers a product of fixed cost.

J. M. Church and Ruth Blumberg, Columbia University, before the Division of Industrial and Engineering Chemistry, American Chemical Society, Chicago, Sept. 4, 1950.

—End

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# Chemical Engineer's Bookshelf Estud by Lester B. Pope

# A Course in Global Geography

BARTHOLOMEW'S ADVANCED ATLAS OF MODERN GEOGRAPHY. Meiklejohn and Son, London; McGraw-Hill Book Co., New York. 155 pages. \$8.50.

Hammond's Complete World Atlas. C. S. Hammond & Co., New York. 375 pages. \$5.

Well, look here! Perfectly good space in a technical magazine like Chemical Engineering is being used to talk about a couple of books full of maps. There are two reasons for this eccentric deviation on the part of your editor:

1. You may have noticed that for the past year one book on these pages has received feature treatment. This month we didn't find a technical book of broad enough appeal. These feature reviews have been about books of fairly wide interest: materials of construction, unit operations, industrial chemicals. This month our choice was too restricted; the field was too

narrow. Hence the atlases which are

of almost universal interest.

2. All of us, engineers and otherwise, are going to be increasingly concerned with geography. In normal times an atlas is of value beyond planning of pleasure trips and looking up strange place names. It identifies railroads, locates ports, and performs other services for the engineer who may be interested in the transportation of raw materials or products. Now, whether we like it or not, it looks as if maps were going to be mighty important again. Witness recent events in that vermiform peninsula—Korea.

So there are my two reasons. These established, what did I find out about the two books under scrutiny.

Bartholomew's—J. Bartholomew & Sons, Ltd., are the foremost cartographers in Britain. Author John G. Bartholomew is director of the Geographical Institute in Edinburgh. The Advanced Atlas is the latest in a long series. It has been in existence 80 years and is internationally known for its superb color work and the accuracy of its cartography.

Bartholomew covers the world by regions rather than by countries and gives much attention to physiographic features. Map sizes of the 96 color pages are 9 x 13 in. (The book itself is 10 x 15 in.) Tables of climates and

populations are included as are a short glossary, index, and a brief, lucid section on map projections.

Hammond's-smaller (61 x 91 in.) and thicker (216 pages in color)—is an American product and therefore has state maps. These are interesting in one respect: land relief is incorporated to produce a three-dimensional effect. Railroads are shown but not highways-the maps are too small to compete with gas stations' gratis examples of single-purpose cartography. The U. S. index includes 1940 census figures. An illustrated gazetteer of the United States is another feature of potential interest and value. The rest of the world is illustrated adequately for most purposes. A gazetteer and index is included.

Verdict—Bartholomew's is a global atlas as complete as possible without becoming unmanageably bulky for ready reference and easy handling. Hammond's is a handy atlas with emphasis on the United States. Both will supplement and be supplemented by the maps we see in our daily newspapers.—LBP

#### Thermodynamics Only

CHEMICAL THERMODYNAMICS. By Frederick D. Rossini. John Wiley and Sons, New York. 514 pages. \$6.

Reviewed by Ju Chin Chu

Professor Dodge put in the preface of his famous "Chemical Engineering Thermodynamics": "Why another book on thermodynamics, are there not more than enough on this subject now?" Not only that many books on thermodynamics have been published by different publishers, Wiley alone has published a large number of books entitled "Thermodynamics." It would probably be difficult for the casual reader to appreciate any legitimate reason for this duplication of effort. The fundamentals involved in different books on thermodynamics are of course the same. To serve for different groups, different books are written to stress particular view points and to indicate the applications specific to different practical problems involved.

Professor Rossini has contributed his extensive experience over a quarter-century in researches and lectures

on chemical thermodynamics to write this book for the interest and greatest usefulness to chemists. The topics in the book are treated in a logical order to lead the readers to a full understanding of modern chemical thermodynamics without experiencing any difficulty. As most books on chemical thermodynamics present the third law of thermodynamics first and discuss the statistical calculation towards the end of the book, this treatment is in the order of their development. In Dr. Rossini's book, statistical calculations precedes the chapter on entropy and the third law of thermodynamics as a logical order to the student's

understanding.

The book divides itself into 35 chapters and the appendix including tables of fundamental constants and conversion factors for calculations. The first five chapters explain the definitions and fundamental concepts such as the present status of the scale of temperature, calorie, joule, systems and process. First law of thermodynamics and its applications are covered in the next five chapters. Chapter 6 presents the concept, magnitude and occurrence of energy and the first law of thermodynamics. The equivalence of energy and mass, change of mass in thermodynamic processes and illustrations with nuclear reactions are explained in Chapter 7. Chapter 8 discusses energy change accompanying a physical process or chemical reaction. Reference state of thermodynamic properties, energy contributions and the statistical calculation of thermodynamic functions are explained, with particular care, in Chapter 19. The third law and its historical development are described along with entropy of nuclear spin, mixing isotopes, different systems at absolute zero in Chapter 20. Chapters 21, 22, and 23 deal with equilibrium constants, free energy change, phase equilibrium of pure substance, fuga-city and its evaluation. Chapters 24, 25, 26 and 27 discuss the solution in the order of partial molal quantity, ideal solution, dilute real solution, activity and activity coefficient of components in a real solution. Numerous methods for evaluating activities in a solution have been extensively discussed. Standard free energy change and its relation with equilibrium constants are discussed in the light of chemical applications in Chapter 28. Chapter 29 deals with the thermodynamics of (Continued)

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BOOKSHELF, cont. . .

galvanic cell. Applications of thermodynamics to strong electrolytes and the Debye-Hückel theory of the latter in dilute solutions are the topics of Chapters 30 and 31. In Chapter 32 is discussed phase equilibrium of binary or multi-component systems. The last three chapters give special applications, illustrative calculations and sources of chemical thermodynamic data.

The outstanding feature of the book is the presentation of each topic with-out historical sketch. Where the historical developments are significant they are given at the end of each chapter. The chapters on "Thermo-dynamic Functions from Statistical Calculations" and "Entropy and the Third Law of Thermodynamics" are the most commendable and highly recommended to those who are not familiar with this phase of modern thermodynamics. The chapter on "Thermodynamic Calculations" has presented, among other things, practical problems most interesting to chemical engineers as well as chemists. They include synthetic fuel, synthetic alcohols, graphite transition, purity evaluation from freezing point measurements, fractionating processes, tolucne for explosives, iso-octane for aviation fuel, styrene, isoprene, isobutene, and butadiene for synthetic

rubber. The author explains the basic concept in a straight-forward manner with special emphasis upon the applications to chemical and physical systems. Problems and illustrations including schematic diagrams have been included to increase and test the reader's capacity of understanding. References and collateral readings are adequately given for those readers who like to carry the study beyond the level of a text. For those chemists who have had physical chemistry, the book should prove to be an excellent text in chemical thermodynamics. Most chapters in the book can be useful to chemical engineers who, in solving complex problems in indus-tries, have to use lots of empirical relations including generalized correlations not discussed extensively in this book.

#### Not the Answer

CHEMICAL ENGINEERING COSTS. By O. T. Zimmerman and Irvin Lavine, Industrial Research Service, Dover, N. H. 419 pages. \$7.

The idea behind this book is excellent but its execution leaves much tobe desired. In their preface theauthors express the hope that "it will



Produce solids-free water of exceptionally high purity...Penfield induction deliciting units such as the 1000 gals./hour model illustrated at right, transform raw water into enform quality water containing zero to two parts per million of ionizable saits and a pH of 6.5 to 7.5 — under the proper conditions, even remove CO<sub>2</sub> and SiO<sub>2</sub>. Electric conductivity meters provide confuneus indication of purity, warning when resin need simple regeneration.





#### RECENT BOOKS RECEIVED

Analytical Chemistry Of the Manhattan Project. By C. J. Rodden. McGraw-Hill. \$6.75. Chemical Thermodynamics. By I. M. Klotz. Prentice-Hall. Distillation Equilibrium Data. Ju Chin Chu. Reinhold. \$6. Elements of Fractional Distillation. By C. S. Robinson & E. R. Gilliland. McGraw-Hill. \$7. Handbook of Antibiotics. A. L. Baron. Reinhold. \$6.50. Indentation Hardness Testing. By V. E. Lysaght. Reinhold. \$5.50. Indentation Hardness Testing. By V. E. Lysaght. Reinhold. \$5.50. Indentation Hardness Testing. By R. Kunin & R. J. Myers. Wiley. \$4.75. Natural and Synthetic High Polymers. By K. H. Meyer. Interscience. \$15. The Physical Chemistry of Dyeing. By T. Vickerstaff. Interscience. \$15. Sorbeans and Soybean Products. Vol. I. By K. S. Markley. Interscience. \$11. Superfluids. Vol. I. By F. London. Wiley. \$5.

help to give all chemical engineers a better appreciation of the importance of costs." It will do this and more—it will also give them a better appreciation of the importance of expressing cost data on a consistent basis and in a convenient form.

The title is much too broad and allinclusive; apt to be misleading. A more descriptive and accurate title might be, "Engineering and Economic Factors Entering into Selection of Chemical Process Equipment." The ratio of technical information to economic data varies from one chapter to another, but the over-all average favors the technical side. Not that the technical data are of little value, for such an implication would be unfair. But the subordination of cost data in many cases is rather surprising in view of the announced purpose for publishing a new book in the process equipment field. For example, Chapter 14, which deals with centrifugal pumps, consists of approximately 12 pages of good engineering information concerning pump selection and design and only 11 pages of cost data. This is, fortunately, an extreme example. The proportion of cost data is much more favorable in the treatments of evaporators and dryers.

Each chapter, excluding the first and last, deals specifically with a given-type of equipment and is authored by a manufacturer's representative in the particular field. This arrangement inspires more confidence in the soundness of the factual material than would otherwise be possible. It also creates wide differences in the content and style of treatment for each subject. A better editing job would have improved the book immeasurably.

It is gratifying to see some attempts to provide operating cost data. A noteworthy example is a tabulation of elec-(Continued)





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BOOKSHELF, cont. . .

tric energy consumption, manpower requirements, and maintenance costs for a number of typical centrifuging operations.

This book, unfortunately, is not the answer to the chemical engineer's prayer. Perhaps in a second edition more time and care can be given to improving the presentation and filling in obvious gaps in the knowledge. The publishers have announced their intention of issuing quarterly supplements in order to provide new and up-to-date cost information. Maybe these supplements will prove to be of more real value than the book itself.—CHC

#### Less Than 100 ppm.

COLORIMETRIC DETERMINATION OF TRACES OF METALS Second Edition. By E. B. Sandell, Interscience Publishers, New York. 665 pages. S9.

#### Reviewed by M. E. Auerbach

The first edition of this work, published in 1944, contained 480 pages; the second edition runs to 665 pages. In his 6-line preface to the second edition, Dr. Sandell explains the expansion thus: "Although hardly any new colorimetric reagents of importance have been introduced since the first edition of this book in 1944, there has been a flood of papers on further application of previously known reagents."

Roughly one fifth of the book is devoted to a general introduction, and the rest to a detailed consideration of 45 metals and the rare earths. The general part, showing only minor changes from that of the first edition, deals with the scope of the methods, precautions, limitations, and classifications of colorimetric methods, and a description of the more important colorimetric reagents. The special part discusses procedures for the determination of traces of each of the metals. It is to be noted that the author goes along with the general accepted idea that the word "trace" indicates a concentration of about 100 parts per mil-lion, or less. The individual chapters, one for each metal, are subdivided into Separations, Methods of Determination and Applications.

In each of these divisions, the aim of the author is to be selective rather than all-inclusive. To use his own words, "The treatment is to a considerable extent based on the experience of the writer in testing or using various methods." It may not be amiss to add that the writer is professor of analytical chemistry at the University of Minnesota. The hand of the ex-

perienced teacher and laboratory worker is apparent in every chapter of the book, in practical hints, lucid explanations, and careful documentation.

The specialist in each of the several fields of chemical analysis will undoubtedly find that Sandell's book does not fulfill his whole needs; and the research worker will certainly also wish to study the recent monumental and idea-provoking work by Fritz Peigl (Chemistry of Specific, Selective and Sensitive Reactions). But when the specialist finds it necessary to venture from his own corner, he would do well to take Sandell as his guide.

#### Really New

GERMAN-ENGLISH TECHNICAL AND ENGINEERING DICTIONARY. By Louis De Vries. McGraw-Hill Book Co., New York. 928 pages. \$20.

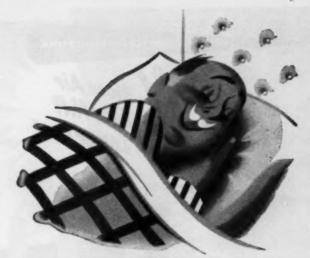
This really new book has been compiled in a manner that is unusual for a foreign-English dictionary. The author invited the cooperation of more than sixty collaborators, all of them active workers in colleges, experiment sta-tions, industry and the armed forces. In this way he gleaned thousands of technical terms which had never appeared in any prior dictionaries. Even such recent developments as radar, television and jet propulsion are repre-sented. In fact, the technical nomenclature connected with developments of the last ten years has been given particular attention among the more than 125,000 entries. It is a book which is well worth adding to the library of every chemical engineer.

#### Heat and Mass Transfer

INTRODUCTION TO THE TRANSFER OF HEAT AND MASS. By E. R. G. Eckert, with an appendix by Robert M. Drake, Jr., McGraw-Hill Book Co., New York. Pages. \$4.

#### Reviewed by James Kalil

The book is meant as a text, on the graduate level, on the principles of heat and mass transfer. The author has translated and modified his original German text. It is concerned mainly with heat transfer, limiting mass transfer to a short chapter, although the analogy between heat and mass trans-fer is emphasized. Throughout the book, the basic laws of heat transfer, and the supporting experimental evidence are stressed. It is the author's purpose to give the reader a clearer insight into the mechanism of heat transfer from fundamental principles, rather than application of the theory; and in this it is felt that a definite (Continued)



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BOOKSHELF, cont. . .

need is satisfied in the field of heat transfer texts.

The heat transfer section is divided into three parts: conduction, convection, and radiation. Under conduction, the basic equations of steady and unsteady state, and the specific equations for heat transfer through conventional shapes including fins, are discussed.

In the convection chapter the boundary layer of heat transfer as expounded by Prandtl, von Karman, and others is dealt with quite comprehensively. There are also sections on free convection, condensation, and evaporation.

The book, on the whole, is well written, and will serve as an excellent advanced text in heat transfer theory.

#### For Mature Outlooks

A TEXTBOOK OF BIOCHEMISTRY. Second edition. By Phillip H. Mitchell. McGraw-Hill Book Co., New York. 661 pages. \$6.00

Reviewed by E. W. McChesney

Rapid advances in many fields of biochemistry have necessitated a revision of Prof. Mitchell's text which appeared in 1946. In the process of revision there has been an over-all expansion of 10 percent in size, the additions being principally in the chapters on carbohydrate chemistry, the vitamins, enzymes, metabolism of foodstuffs, and the chemistry of the hormones. Each chapter includes numerous references to recent monographs and reviews, and to some especially significant original articles. It thereby provides the logical basis for an introduction to the biochemical literature. The author's treatment of the field is thorough and painstaking. In general he sticks very close to the original source material, and tries to omit nothing which may have a bearing on our present or future point of view. In effect, it is addressed to the student whose interest goes beyond the mere what to the how and why. It is assumed that the reader is well grounded in both physical and organic chemistry and is capable of at least a moderate amount of independent judgement. Some of the chapters would undoubtedly leave the moderately well prepared student in a state of confusion as to what his conclusions should be, but this per-haps merely reflects the state of flux in those fields. Typographical errors are to be found, but they are few in number considering the magnitude of the task. There are occasional statements and phrases to which

one takes exception. For example, (p. 415) what is meant by the hydrolysis of water, from what (p. 432) does digitonin derive its buffering effect, and what (p. 642) is the difference between atebrin and atabrine? Nevertheless, this represents a valuable reference work, and would serve as a satisfactory text for students with the proper maturity of outlook.

#### In Easy Stages

ORGANIC CHEMISTRY. Second edition. By Louis F. Fieser and Mary Fieser. D. C. Heath and Co., Boston. 1,125 pages. \$7.50.

The fundamental chemistry of the various classes of compounds has been unfolded in casy stages. Interspersed in their logical places are applications to biological and medical sciences and to technology. Out of a total of 42 chapters, only 27 (1-4, 6-12, 15-17 and 22-34) would be needed for a begining course. The complete book is intended to be useful for orientation in specialized fields of natural products, in theoretical organic chemistry, in various phases of biochemistry, in microbiological chemistry, in chemotherapy, in the technology of petroleum, rubber, dyes, and plastics.

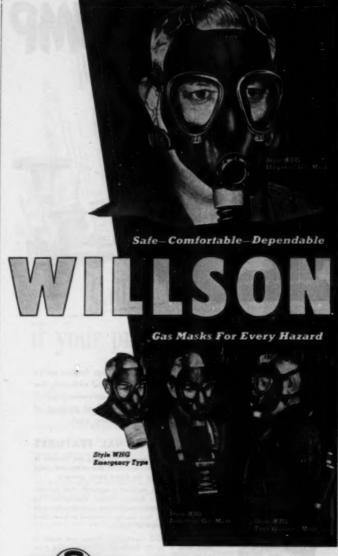
This edition has two new chapters, one on heterocyclic compounds and one on reaction mechanisms. Modernization is particularly apparent in the chapters on dyes, plastics, fibers and stereochemistry. The many uses of lithium aluminum hydride and of the alkali metal borohydrides, and the expansion of acetylene chemistry are examples of new entries derived from recent literature and from technical reports on German research and manufacture. Wherever feasible, the authors have laid emphasis on interpretations derived from electronic concepts and the theory of resonance. -FA

#### New Book

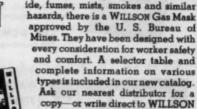
SOLUBILITY OF NON-ELECTROLYTES. Third Edition. By Joel H. Hildebrand and Robert L. Scott. Reinhold Publishing Corp., New York. 1950. 488 pages. Price \$10.

#### Reviewed by F. C. Nachod

The third edition of this American Chemical Society Monograph bears no resemblance to the previous one which appeared 14 years ago save the title! Enlisting the able cooperation of Dr. Scott as junior author, Dr. Hildebrand has been able to bring this text up-to-date by expanding it nearly two and a (Continued)







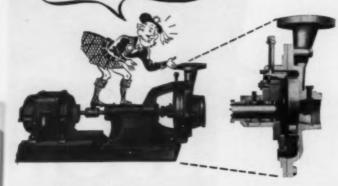
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BOOKSHELF, cont ...

half fold in size. Such drastic revisions and enlargements will probably be the fate of most ACS monographs older than 15 or more years and it is gratifying indeed to see that Prof. Hildebrand is setting the pace so well.

As the present text then is practically a new one, there are few typographical errors; but more annoying is the poor printing . . . absence of suitable page margins which give the reader an impression of "pinching." Aside from these more formalistic objections the book deserves nothing but praise and should be of immense usefulness to investigators in various fields of research.

#### Best to Date

PRINCIPLES AND PRACTICE OF SPECTROCHEMICAL ANALYSIS. By Norman H. Nachtrieb. McGraw-Hill Book Co., New York, 1950. 324 pages. \$4.50.

Reviewed by Edwin K. Jaycox

Nachtrieb's book, "Principles and Practice of Spectrochemical Analysis," ranks high among all the books that have been published in the field of applied emission spectroscopy. The organization of the material is excellent. The author's logical development and presentation of his subject makes this book outstanding as a textbook for students and new workers in the field, as well as a ready reference book for experienced spectroscopists who will find many valuable ideas throughout its pages.

The book is divided into two parts. In Part I, following a short but pointed historical sketch of the development of analytical spectroscopy, the author dis-cusses the role of spectroscopy in analytical chemistry as played in modern laboratories. He deals with the layout, organization and operation of a spectrochemical laboratory, lists minimum essential equipment required and discusses costs of installation and operation, the latter of value to those who contemplate the installation of spectrographic equipment. The theory of refraction of light by prisms and the diffraction of light by slits and gratings is developed. Contemporary prism and grating spectrographs as well as direct reading instruments are described, and their best areas of application evalu-ated. A chapter is devoted to each of the following subjects: the photographic process, accessory equipment, the evaluation of photometric data, the origin of spectra and the excitation of spectra. In these chapters a firm foundation is laid to enable the reader to understand the application of emission

spectroscopy to the problems of chemists and engineers, particularly with regard to the determination of and the control of the composition of materials.

The second part of the book is one of the best treatises on the practical application of emission spectroscopy that has been written to date. The subjects of qualitative and quantitative spectrochemical analyses are covered in a comprehensive manner, interspersed with detailed descriptions of typical applications and procedures. The author is obviously thoroughly familiar with the literature of this field and has included in his presentation discussions of many sound and enduring practices originated by others and in a number of cases presents data from original sources giving full acknowledgment in each instance. By this means selected typical techniques applicable to the quantitative spectrochemical analysis of metals, refractory materials and solutions are presented in considerable detail. The case for chemical-separation techniques is presented as a means of enlarging the field of application of emission spectroscopy by utilizing other established procedures such as electrolysis, solvent extraction, organic complexing agents, carrier precipita-tions and manipulative microtechniques, to convert samples to a form more readily susceptible to analysis with the spectrograph.

It is of course impossible, within the confines of the covers of a single book, to discuss all the techniques that have been described in the literature and used successfully by many workers. The author has, however, succeeded in presenting to the reader a reasonably complete picture of the field of applied emission spectroscopy, in certain areas in considerable detail, and in others by reference to specific papers in the literature. The book merits a wide circulation among chemists and engineers and it should be given serious consideration for use as a text book in colleges and universities.

## Recent Books

Materials of Construction. For each of thirteen major corrosive chemicals; recommendations about the more important construction materials. Includes a comprehensive manufacturers' directory of materials including metals and alloys, carbon, cements, plastics, refractories and rubber. Reprinted from November 1886, Chemical Engineering Metal Construction and the construction of the cons

Atem Bessb. "How to Size Up the Atom Bomb." Physical effects—temperatures, pressures, velocities, radiant heat, radioactivity. Shows how the bomb burst acts on people and structures. Reprinted from Power, October, November 1959; January 1951. 16 pages. Power, Editorial Dept., 320 West 42nd St., New York 18, N. Y. (Continued)



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BOOKSHELF, cont. . .

Civil Defense. "Civil Defense in Your Community." Information for industrial leaders as well as chambers of commerce as an aid to participation in civil defense planning in the community. 17 pages. 29 cents. Committee on National Defense, Chamber of Commerce of the United States, Washington 6, D. C.

Califerala. "Mineral Commodities of California." Geological occurrence, economic development, and utilisation of California's resources, embracing more than \$6 types of raw materials of commercial and strategic importance. Attached map shows distribution of state's mineral deposits, major rock units. 445 pages. \$2. Bulletin 156, California Division of Mines. Ferry Bidg., San Francisco 11, Calif.

Petroleum. "Petroleum Products and Lubricants." In their latest forms, 125 ASTM standards, including 113 test methods; 8 specifications; 3 lists of definitions relating to petroleum, specific gravity, and rheological properties of matter. '39 pages, \$5.50. American Society for Testing Materials, 1916 Race St., Philadelphia 2, Pa.

Market Research Sources. National inventory of available market research material. 261 pages. 22.25. Ninth edition Superintendent of Documents, Washington 25, D. C.

Equipment Cost. "Process Equipment Cost Estimation." A collection of 40 articles written by specialists and published in Chemical Engineering during the past few years. Some topics covered are: ejectors and condensers, separators, spray dryers, piping, tanks, spheres and drums, ion exchange, pilot plants, and cost data correlated. 125 pages. \$1.50. Chemical Engineering, Editorial Dept., \$30 West 42nd BL. New York 18. N. Y.

Atomic Energy and Patent Law. Picks out the sections of atomic legislation that affect the inventor and interprets them. By Theodore Hafner. 17 pages. 25 cents. Theodore Hafner, 39 Broadway, New York 6, N. Y.

Finance. "Facts and Figures on Government Finance, 1950-1951." Interpretation of all facts about the cost of government. Includes 165 tables and 11 charts. 224 pages. \$2. Sixth edition. Tax Foundation, Inc., 30 Rockefeller Plana, New York 26, N. Y.

Distilled Spirits. "Gaging Manual." Instructions and tables for determining the quantity of distilled spirits by proof and weight. 8. Superintendent of Documents, Washington 25, D. C.

Explosives. "Code of Federal Regulations, 1949 Edition. Title 49. Transportation, Paris 71 to 77." Rules and regulations governing the transportation of explosives and other dangerous articles, the means by which they may be shipped and how they must be marked when shipped. 32. Superintendent of Documents, Washington 25, D. C.

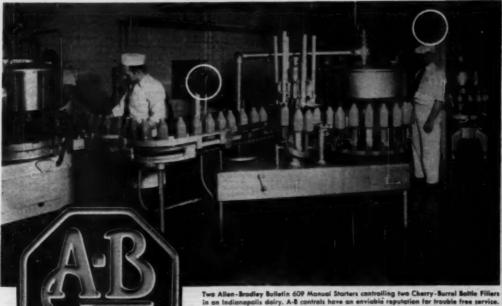
Bureau of Mines. "List of Publications of the Bureau of Mines." Accumulative list from the founding of the bureau to January 1949 with complete subject and author index. 32. Superintendent of Documents, Washington 25, D. C.

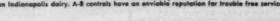
Proceedings. "American Gas Association Proceedings." Contains all the technical as well as general records of the 1949 meetings, especially the 31st annual meeting. \$3.50 to members. American Gas Association, 420 Loxington Ave., New York 17, N. Y.

Liquid-Metals Handbook. Guide to the use of liquid metals as beat-transfer media. Physical and chemical properties, corrosion resistance, availability, industrial utilization. 188 pages. 81.25. NA-VEXOS P-733, Superintendent of Doctments, Washington 25, D. C.

Weed. "List of Publications on Chemistry of Wood and Derived Products." February 1950. No. R238, Forest Products Laboratory, Madison 5, Wis.

Packaging. "List of Publications on Box and Crate Construction and Packaging Data." February 1930. R791. Forest Products Laboratory, Madison 8, Wis. —End







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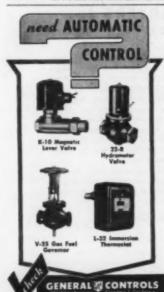
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#### NEW TECHNICAL LITERATURE

	Reader Service numbers. Circ card inside the back cover	
SUBJECT	PEATURES	COMPANY
Hand Trucks 274A	Battery-powered and motor driven trucks and gas- powered trucks driven by hydraulie pump and hydraulie motor. Sketches abow features, dimensions and mount- ing data for each. Fully assembled units and applications are also illustrated. 12 pages.	Clark Equipment Co
Piping System 274B	Pulsation dampening piping system, furnished in pro- fabricated form. Diagram shows design; system's effect is graphically presented. 4 pages.	Fluor Corp. Ltd.
Traveling Crance 274C	Light seams and menorall system for leads from 250 to 20,000 lh. Photographa, sketches show where and how system may be used in transport, lifting or lowering, stacking or tiering. Includes a page of engineering draw- ings giving dimensions and espaciation. 20 pages	Whiting Corp.
Speed Centrel 274D	Three units: Variable speed transmission: Motordrive, Vari-speed meter pulley. Operating principles, internal operating parte accessories, special designs; all illus- trated. Charte ive over-all dimensions and horsepower capacities. 12 pages.	Reeves Palloy Co.
Water Füters 274E	Pressure fitration systems are diagrammed and keyed in color to show many industrial applications. Cutaway views, operating data and piping suggestions for single and battery installations. Discussion of development of today's fifter media and backwashing techniques, instud- ing continuous automatic backwashing. 22 pages.	R. P. Adams Co.
Vibrating Screen 274F	Concentric action vibrating screens for medium and heavy duty service. Photographs show design and operation. Detailed dimension, veights and other engineering layout data. How to select the right size screen for handling a given capacity of material per hour over square openings of up to 2 in. 12 pages	Link-Belt Co.
Castings] 274G	Pictures castings for the pulp and paper industry includ- ing beater rolls, plug sleeves, rag slitters. 4 pages.	Taylor-Wharton Iron & Steel Co.
Pano 27418	Mechanical draft fans for both forced and induced draft service. Drawings of typical fans and photographs of representative installations. Performance curves show efficiencies of various types of fans over a wide range of speed and delivery conditions. Details on construction, drive arrangements, mounting methods. 20 pages.	Green Fuel Econom ser Co.
High Pressure 2741	Industrial and laboratory high pressure equipment, intensifiers, pumps, reaction chambers, instruments, fit- tings, tabing, valves. Photographs, installation draw- ings, design drawings, specifications tables, stress and strain table. 27 paged:	Harwood Engineering
Packings 2743	Pictures, construction descriptions, recommended applica- tions, conditions of use for the members of a complete line of mechanical packings. A few of the types instituded are rubber bank, center care, Tefon, centrifugal pump and braided asbestos packings. Charts give standard sissa and approximate it. per lb. 32 pages.	Flozroek Co.
Synthetic Fiber 274K	Suggested uses for Dynel, a new staple fiber made from vinyl obloride and aerylonitrile. Table gives properties.	Carbide and Carbon Chemicals Division
Wire Cleth 274L	Five sections: (1) Specifications, characteristics, uses of wire cloth and filter cloth. Photographs show various meshes. (2) Pabrication service. (3) Engineering design service. (4) Wire cloth structures are graphically desirbed with photographs and drawings. Describes a Columbia University project to determine relationship between pressure drop and flow rate of any fluid through various metallic cloths. Also discussed is an investigation to determine cise of particles which can be retained by various filter cloths. Flow diagrams, charte, graphs, photographs. (5) Analyses, corrosion resistance and melting points of metals. 125 pages.	Multi-Motal Wire Cloth Co.
Durting 274M	Flexible and rigid fiberglass dueting, hose, sleeves and couplings. Lists data on weight, working temperature ranges, dissign working pressures, leakage factors. For flexible convoluted and wire supported types, gives clongation and compression limits, minimum bend radii. Conter ceread in directed to charts and graphs giving comparative characteristics of over 130 types and constructions available. 16 pages.	Arrowhead Rubber Co
Cantings 274N	Photographs and specifications for a line of stainless steel castings. 4 pages.	Ohio Steel Foundry
Analysis 274P	"Better Analysis," an illustrated periodical publication of Baird Associates, Inc. New developments, tips on how the company's instruments may be used to best advan- tage.	Baird Associates, Inc.
Metallizing 274Q	Photographs and text cover applications of a process for protecting metals against heat oxidation. 4 pages.	Metallizing Engineering Co.
Chemicals 274R	Four bulletins. One on glacial acetic acid. Physical and chemical properties, laisest specifications, chipping and handling information. Another covers the same ground for codium acetate. 2 pages. The third sovers sucress	United States Vans dium Corp.

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NEW TECHNICAL LITERATURE, cont. . .

SUBJECT	ERATURES	COMPANY
Organic Chomicaia 276A	Prize list on over 2400 organic chemicals. Covers this company's regular line plus several hundred new compounds. 32 pages.	Matheson Co.
Instruments 276%	Diaphragm ball transmission arm for liquid level con- trollers and control valves. Photographs show various models. 3 pages.	Davis Regulator Co.
Supplies	Lists over 25,000 items of laboratory apparatus and sup- olies. Items are listed by name and again, separately, by function. A description secompanies every listing. Leather binding. Requests must be made directly to the company on letterhead stationery. Catalog 460, 986 pages.	Burrall Corp., 2223 Fifth Ave., Pitteburgh 19, Pa.
Organic Chemicals 276C	Price list, as of Outober 1950, for chemicals including casential cile, aromatics, colors, fixitives. Distribution is limited to those who buy in wholesale quantities. If pages.	Fritzsche Brothers, Inc.
Resins 276D	Covers ten resins, most of them nowly developed, recommended for use as finishes. Properties, applications.  16 pages.	U. S. Industrial Chemicals, Inc.
Soda Ash 276E	Masual includes chapters on production and uses, methods of masufacture, forms and grades, unloading and hand- ling. Numerous photographs and diagrams. Graphs and charts help summarise properties. Methods of analysis are outlined. Requests must be made directly to the company on letterhead stationery. 64 pages.	Pitteburgh Plate Glass Co.
Reservinol 2769	Use in fibre-reinfereed rubber goods. General prosedure in the use of resorcinol-formaldehyde latez formulations, typical formulations for adhesives, applications of the adhesive to the cord or fabric. 6 pages.	Koppere Co.
Plasticisers 278G	Plasticipers used with polyvinyl chloride resins for film and sheeting. Selection, types, blending of plasticipers. Resommended polyvinyl chloride formulations. 12 pages.	Monanto Chemical Co.
lasiramenio 276H	Three bulletins. One covers measurement and omtrol of temperature and pressure. Includes photographs of the instruments, diagrams showing installation arrangements, selection charts. 12 pages. The second covers flow meters. Photographs and aktobes show various models and installations. Dimension diagrams and controlling instruments for use with flow rate meters. The charts, 12 pages. The third covers exhibiting and controlling instruments for use with flow rate meters. The chart of the controlling instruments are the indicator, resorder, integrator and presumatic controllier. Construction and operation descriptions are liberally illustrated. 28 pages.	Fischer & Porter Ca.
Chemicalo 2762	Specifications, physical and typical characteristics of 12-hydrogenated caster oil. Discusse typical and suggested uses based on preliminary experimentation.	Emery Industries, Inc
Bredno 276J	Corrosion resistance, uses, application and cost of a medi- fication of phenol formaldehyde resins that requires no baking to obtain maximum hardness and corrosion resist- ance. 2 pages, Another bulletin covers two formu- tations of synthetic rubber centings, one being com- pounded for use on metal and concrete and the other for use on woad subjected to centinual immersion in water or very moist conditions. 2 pages.	Carbeline Co.
Valves 276K	Water pressure relief valve in sizes 2 1/2 to 16 in. Sectional diagrams, the relief pilot valve, general and installation arrangements. Parts, materials and dimen- sions are tabulated. 3 pages.	Golden-Anderson Valve Specialty Co.
Steam Trape 276L	Photographs show design and construction of inverted bucket type steam traps. Specifications, capacities, sizes, pressures, weights, prices. 4 pages.	V. D. Anderson Co.
Materials Handling 276M	For each model in a line of industrial trocks: a photograph and dimensional drawing showing construction; a series of snapshots showing uses and operation. S pages.	Kniekerboeker Co.
Analysis 276N	Describes this company's facilities for the rapid determination of particle size distribution of fine powders by a new, reproducible method. Report is illustrated with graphs and charts. 17 pages.	Samuel P. Sadtler & Son
Conting 276P	Application suggestions for a conting known as Zinellate. The nine in the coating itself is said to be protested from atmospheric oxidation. Chart gives degree of resistance to various corrosive conditions. S pages.	Incustrial Metal Protectives, Inc.
Pumpo 276Q	Sections on pumps for corresive and non-corresive liquids, for solids-carrying liquids, for dry and semi-dry materials. Fully illustrated. 12 pages.	Yeomans Brothers Co
Drive 276R	Variable speed transmission series incorporating a tandem belt design which suits series for applications where space limitations require extreme compactness. Known as Model A. Drawings and pitotographs show construction, dimensions of various types. Chart gives horsepower ratings at various output speeds. 6 pages.	Worthington Pump and Machinery Corp.
Plantire 2785	Three bulletins. One covere modification by heat treatment of the physical properties of this company's Kel-Fulation. I pages. Another covers moding techniques: injection and transfer modding. Procedure and materials used are described, equipment is pictured. Spages. The third is on properties and methods of applying Kel-F dispersions. I pages.	M. W. Kellegg Co.
Regulators 276T	Three capacity charts for regulators: for steam, air, gas and liquid; for air and gas; for liquid. 3 pages.	Davis Regulator Co.









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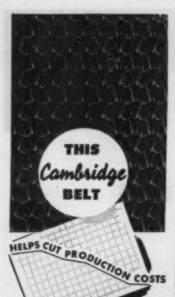
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Equipment 278A	noteback with tabuladous anctions on engineering conte	
Hydrocarbons 278B	Price list for the research, gure, technical and commercial grades of hydrocarbons which this company has available. Also covers aliphatic sulphur chemicals. 12 pages.	Phillips Petreloum Co
Liquid Nitrogon 278C	Use of liquid nitrogen to solve problems encountered in specialty grinding. Case histories, suggested applications. 4 pages.	Linde Air Products Ce
Coment 278D	Coneral features and proporties of resinous erment said to be seid and alkali proof. Recommended for pickling tanks, sewers and pits, chemical process tanks, industrial floors. 4 pages.	Nukem Products Corp.
Tubing 278E	Technical data eard on the chemical compositions of seam- less alloy steel tubing, specifically steels of the lew and intermediate alloy groups. These apply to pips for high- tem persture service and tubing for use in heat exchangers, condensers, refinery stills, bollers.	Babecck & Wilcox Tube Co.
Speed Reducers 278F	Photographs and brief descriptions of a line of gear speed reducers. They include spiral bevel gear, spiral bovel herring-boto, helbeat worm gear, motorised beliefs. 4 pages. Another bulletin covers worm gear speed reducers archiavely. They are made with a horizontal worm at- botism, worm at top or vertical drive. General specifica- tions, rating tables, dimensional blueprints. 8 pages.	D. O. James Gear Mfg. Co.
Poodors 278G	Stainless steel and Tefon models. Photographs show various types. Discusses espacity and corrosion resistance. 4 pages.	Clarkson Co.
Welding 2788E	Fabrinating and assembling manual of welding engineer- ing and design. Characteristics, properties, applications and operational procedures for alloys and fluxes made by this company. Text is generously interspersed with sketches. Much dain is presented in tables. 44 pages.	Euteotic Welding Allaye Corp.
Materials Handling 2781	Pictures and gives method of operation, dimensions and capacities for revolving carriages for use on fork lift trucks. 2 pages.	Townstor Corp.
278J	Centrifugal pump in which all parts except the bare pump- casing are contained in one easily replaceable rotor assembly. Construction is shown by photographe of cross section and individual parts. Dimension print, rating tables. # peace.	De Lavai Steam Tur- bine Co.



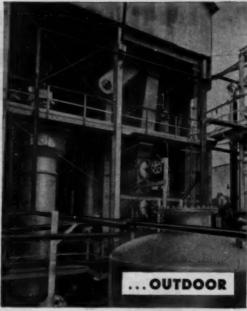
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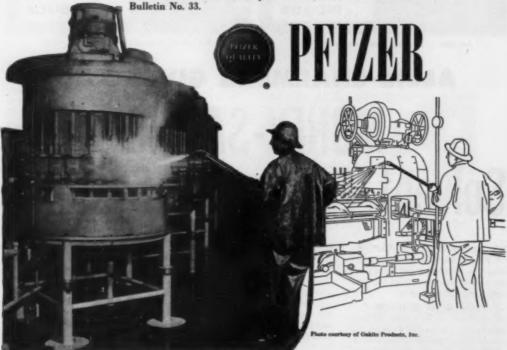
CHEMICAL ENGINEERING-January 1951

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Gluconic acid is the choice for these detergents because: 1.—It has an extremely low corrosion rate, (one-twentieth that of phosphoric acid on iron surfaces); 2.—It is non-toxic, as evidenced by its usage in food and pharmaceutical products, and 3.—It is non-volatile, a factor of importance where high temperatures may be expected.

Odorless solutions of gluconic acid are also being used successfully to prevent the development of milk-and beerstone formation, without affecting the product flavor. For complete descriptions of these and other uses for this mild, inexpensive acid, write for Pfizer Technical



# GLUCONIC ACID

AMMONIUM GLUCONATE - CALCIUM GLUCONATE - COPPER GLUCONATE - FERROUS GLUCONATE - MAGNESIUM GLUCONATE - POTASSIUM GLUCONATE - SODIUM GLUCONATE

CHAS, PFIZER & CO., INC., 630 FLUSHING AVE., BROOKLYN 6, N. Y.; 425 NORTH MICHIGAN AVE., CHICAGO 11, ILL.; 605 THIRD ST., SAN FRANCISCO 7, CALIF.

### Mobilization Means Change In Use-Patterns For CPI

Productionwise, this year is off to a promising start. Unfortunately a good part of our production efforts will be directed into defense channels as our mobilization program gets boosted into high gear. Six months after the sneak attack by the communists in Korea we are beginning to flex our industrial muscles in an intensified rearmament program. The day of plentiful supplies of industrial chemicals for all of our domestic needs is past. This year the defense requirements will draw on a large part of our chemical products. Many non-essential users will find their chemical supplies cut drastically before the end of this year.

This is part of the sacrifice that we must be willing to make to defeat the menace of world communism. The soldiers and marines fighting and dying in Korea certainly have the right to expect us to drop our "Business as usual" policy for the over-all good

of the nation.

One of the biggest markets to feel the pinch will be exports. In the next twelve months sales to overseas points of alkalis, minerals such as sulphur, and organic chemicals will probably drop sharply. This is due to the fact that it takes time to build new facilities that will meet our expanding needs. It will also take a large amount of money.

With construction and raw materials costs rising, it is time to look again at processes that were not economic in the past. Sulphuric acid presents a good example of this problem.

What Price H<sub>o</sub>SO<sub>4</sub>—In the past few months there has been considerable discussion about the shortage of our largest commercial chemical. With gross sulphuric acid production approaching a record 12.6 million-ton mark this year, we still have not satisfied the existing demand.

This year we consumed about a million more tons of acid than we did in 1949. This is the real reason that acid is short. Our national rated capacity (which can be exceeded by pushing) is estimated at about 12 million tons. So it is evident that we are exceeding our acid capacity by a sizable amount. These rates have been the result of a phenomenal peacetime de-

Supply & Demand

- Chemical consumption is running more than 10 percent ahead of prior annual rates. See page 121.
- Prices continued to climb this month.
   Both chemical and fats & oils indexes were up. Chemical prices climbed almost 18 percent in 1950.
- Supplies of chemicals are short of demand. Some uses will be cut.

mand. War orders have had very little effect on last year's output. Next year we will probably need at least another million and perhaps 2 million tons of acid for direct military uses.

Where are we going to get it? First reaction is to build more acid plants. This will be done. However, the shortage of acid goes deeper than that. Today 81 percent of our new acid comes from sulphur. The rest comes from pyrites or other byproduct sources such as smelter operations; and HoS recovery units. This raw material pattern has developed because of the relative cost of sulphuric acid from various methods used in commercial production. Plants that use pyrites as a raw material are almost twice as expensive to build as those using brimstone for a starting point. This fact along with its low cost accounts for the predominance of Frasch-process sulphur as a raw material for sulphuric acid. However, in recent months the price of that sulphur at the mines has climbed from \$18 to \$22 per long ton. As mining becomes more difficult, costs will rise again.

We are now using 5.4 million tons of sulphur per year. About 75 percent goes into acid. In September, our sulphur shipments exceeded production at the mines by about 87,000 long tons. We can not continue to dissipate our sulphur stocks at this

rate indefinitely.

Sulphuric acid has reflected increased costs and 66 deg. Be. acid now costs about \$3 a ton more than it did in the first part of 1949. If we are going to get sufficient sulphuric acid it is apparent that we must reassess our acid raw materials to see if pyrites, natural sulphates, petroleum, H.S., and smelter units can play a bigger role in supplying our acid needs. In the future, acid will be more expensive as costly raw material sources are forced into commercial operation. But we are not going to run out of acid.

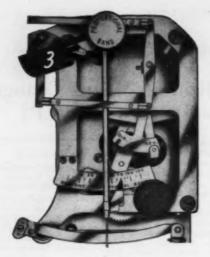
In December, the NPA took the first step to increase our domestic supply of sulphur by cutting the exports of brimstone about 28 percent. Exports of native sulphur in the first quarter of this year will be held down to 200,000 long tons. In 1949 our annual exports reached 1,450,000 long tons. This will mean that at least 600,000 tons will be conserved for domestic use in 1951. This could be used to make at least 2.0 million tons of acid. It will go a long way in helping to solve the short-term raw material shortages, but active consideration of the other acid mw material sources should be continued.

LP-Gas for Chemicals—Liquefied petroleum gases continued to find larger markets in the chemical industry last year. Estimated sales of this raw material for the manufacture of chemicals reached a new high in 1950. More than 650,000,000 gal. were consumed in chemical production. This was almost 20 percent above the 1949 rate. This figure excludes the 207,000,000 gal. used in the production of synthetic rubber last year. Among the more important chemicals manufactured from LP-Gas hydrocarbons are alcohols, detergents, resins, glycols, acetates, antioxidants and special solvents.

Proximity of a source of LP-gas has become a major factor in selecting the location of new chemical producing units. The rapid extension of naturalgas pipe lines into the Midwest and the East has provided an excellent carrier for the light hydrocarbons, and propane-butane extraction units are being considered for strategic locations along such pipelines. Both refinery and natural gas sources LP-gas hydrocarbons are extensively used in chemical output. Refineries supply about 45 percent and natural gasoline plus cycling plants supply 55 percent. Shortages in benzene, styrene, and alcohols are causing intense interest in expanding use of LP-gas as feed-stock in chemical plants.

Location of LP-gas extraction plants on these pipelines will permit location of petrochemical plants in areas some distance from the oil field, gas fields and refineries.

0 0 0 0 1 1 .03 .05 .25 .05 .25 .06 .40 4 .12 .75 5 .16 .120 6 .25 .200 7 .35 .300 6 .70 .500 9 .75	PERIVATIV	SETTING	PATE
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	2.00	7	.35
5.00 9 75	3.00		.50
	5.00	9	.75
	16		1



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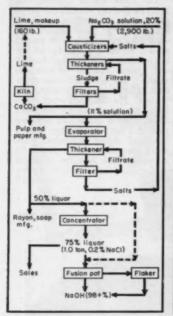


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# Commodity Survey Edited by Richard F. Warren



Brine (set'd. No CI) Na<sub>2</sub> CO<sub>3</sub> (3.2 tons) (10% sol'n) Purifier Co Mg and filtrati salts Clg (0.88-0.95 tons) prox. 501b.) (11-15% NaCI) Evaporators Settler and filter 50% liquor (I ton NaOH, I% NaCI) Evaporator 50% liquo 70-73% liquor Royon grade ((0.2% NaCI) Regular grade ((0.3 % No CI) ((1.5% No CI)

LIME-SODA PROCESS

ELECTROLYTIC PROCESS

#### Caustic Soda

Sodium hydroxide is one of the major alkalis. It serves our economy in many ways. Capacities are growing.

JOHN R. SKEEN, Director of Market Research, Foster D. Snell, Inc., New York, N. Y.

Once again caustic soda is in poor supply. Last June the first of the series of strikes which spread to seven caustic plants combined with the outbreak of war in Korea to create a deficit. Only the previous month the market was termed "stabilized" and there was an oversupply less than a year before. A production loss of about 10 percent, on top of the stimulated industrial demands, depleted stocks rapidly. They remain so today. Developing plans for the national defense program anticipate progressive increases in requirements that will exceed the present capacity to supply. However, if new soda ash and chlorine facilities materialize, caustic soda will be readily available.

Caustic is obtained almost entirely

by two methods. In the chemical process, soda ash is causticized in the presence of lime. Calcium carbonate forms and its insolubility in water is the basis of the operation. The resulting precipitate is removed by either of two contrasting methods while the weak caustic liquor is concentrated to the usual market grades. These are the 50 percent and 70-73 percent liquors, and the "dry" forms—solid and flake. In the second process, the electrolysis of brine, caustic is a coproduct along with chlorine and hydrogen. Less than half the salt is decomposed, and the weak liquor from mercury cells-about 7 percent of the total cells in operation-is almost entirely free of it. In contrast, the salt in the liquor from diaphragm cells must be removed. The procedure, based upon the decreasing solubility of the salt with increasing concentration of the sodium hydroxide, consists

of successive evaporations followed by the removal of salt crystals.

The weak liquor of diaphragm cells, containing over 10 percent salt, can be used in the manufacture of pulp and soap. The 50 percent product contains too much salt (1 percent) for the production of viscose rayon. Accordingly, several methods of purification have been devised. The sulphate process consists in precipitating the triple salt, NaOH-NaCl-Na<sub>0</sub>SO<sub>4</sub>, leaving nearly all the caustic in solution. The method of Hooker and Marsh involves the separation of the crystal NaOH-34H<sub>2</sub>O, again leaving salt in the liquid phase. The D-H process of the Columbia Chemical Div. uses liquid ammonia to extract the sodium chloride. Rayon grades result in all cases.

The chemical process permits the widest variations in procedure. Small plants operate batchwise. Continuous processes are more applicable to units making from 50 to 500 tons daily. In such cases, two or more causticizers are employed and the liquors are then treated in either of two general ways.

In the double filtration system, the overflow of the last causticizer is led to a series of settling tanks. The clarified weak liquor then goes to the evaporators for concentration. The underflow of the last causticizer and the settlers progresses to the filter system. Filtrate is used to dissolve soda ash charge, while filter, (muds of calcium, magnesium, other salts), is reburned in a kiln. Cycle begins again with a minimum of make-up.

In countercurrent washing, the underflow of the secondary causticizer is delivered to a series of washers when it flows against a small stream of water. The equipment is of the multiple-tray type (Dorr, Hardinge), or multiple decanters. The liquor of the final clarifier and the concentrated muds are recycled as before.

The recent growth of the industry has been striking. Before the last war there was an excess cauacity for producing caustic of more than a half million tons. By 1942 over a quarter million tons more in new facilities was provided. The next year the War Production Board planned an additional expansion of 375 thousand tons, represented by 12 plants. However, less than three quarters contributed to the supply as there appeared to be no further need. By the end of 1944. (Continued)

283

COMMODITY SURVEY, cont. . .

WPB announced that there was an adequate amount for all needs.

Both segments of the industry expanded shortly after the war ended. Particularly was this true of the chlorine branch. Government plants were leased, purchased and remodeled. By 1947, almost 1.4 million tons of the electrolytic product was available, nearly three times the amount made a decade before. This growth continued and late in the spring of 1949 a stabilized market resulted. This was short lived, however, and the next year plants were taxed to supply a demand in excess of 2.4 million tons. It appears that the end of this trend is not yet in sight.

Caustic soda has been made from domestic soda ash since 1884 when the industry was established at Syracuse by what is now the Solvay Process Division of Allied Chemical & Dye Corp. Uses were few; the more important were in soap, lye, chemicals, and mercerized cotton. A new market was found with the development of the soda process for treating wood to make pulp for paper. Here the chips are digested with a cooking liquor containing 6-7 percent caustic. Such consumers were among the first to install the electrolytic process and by 1917 about nine pulp makers were using caustic from their own cells. During war years, production nearly doubled and it still wasn't enough.

With the abrupt end of hostilities, a large over-capacity was evident. "Diaphragm" caustic could not compete successfully with the products of the mercury cell or the chemical process. Profits derived mostly from the production of chlorine for which

there was—and still is—a more active market. As with so many other chemicals at the time, new and greater uses materialized.

The rayon market appeared. In 1920, the DuPont Fibersilk Co. joined the pioneer manufacturer, American Viscose Co. In rayon manufacture, wood pulp is steeped in 16-18 percent caustic, which is practically salt-free to give alkali cellulose before treating with carbon bisulfide to form the xanthate. The salt specification stimulated efforts to better the electrolytic product. The outlet was worth it. In 1921, the rayon industry consumed 25,000 tons of caustic and over four times that just a decade later. Growth continued during depression years. Sharp competition for the market developed in both branches of caustic production. It was a question of price. (Continued)

Caustic Soda Producers, Electrolytic Plant Capacities, and Location

Tes	Plant Location	Plant! Began	1940	Approximal 1949	o Capacity*, t	1981
Arvey Curp.*	Momphis, Toun	1947	-	30	26	20
D. M. Bure.	Hoaring Strings, Fa.	1912	1.1	1.1	1.1	1.1
Blown Co.	Borlin, N. H.	1888	41	81	51	86
Champion Paper & Fibre Co	Canton, N. C.	1916	87	<85	56	88
	Hamilton Ohio	1941	-	-		44
	Pasadena, Tex. Jersey City, N. J.	1986	22.8	<88	85	56
Chiera Cimiral Ce	Jerrey City, N. J.	1942	-			
	Caking, Call.	1913	4.5			110
	Denver, Colo	1943	28	110 72	110 78	110 78
Colorado Fuel & Iron Co.	Edgewood, Md	1918	20	245	245	367
Diamend Alitali Co.**	Roustor, Tex Painseville, Ohio.	1948	88	133	133	133
	Pine Bluff, Ark	1943		55	85	78
Dee Chemical Co	Prespect, Tex	1940	168	A00	800	1.000
Date Comments Continued to the Continued	Midland, Mich	1806	200	415	415	875
	Pitteburg, Calif.	1917	76	175	175	200
	Velegon Tex	1942	-	225	205	205
R. L. du Pont de Neuman & Co	Velasco, Tex. Deepwater Point, N. J	1998	19.6	20	20	20
Earlern Mfg. Co.	S. Brewer, Ma.	1916	7	2	7	7
Kerneta Paper Co.	S. Brewer, Mo. Pingah Forest, N. C.	1947	-	4		-
Pinids Point Mfg. Corn.	Providence R. I.	1917				8
Frontier Chemical Co.	Seagraves, Tex	1947	-	26	24	24
Gimeral Electric Co.	Pittsfield, Mam	1946	-	36	25	36
B. F. Goodrich Co.	Louisville, Kv	1942	-	20	20	20 17
Gulf Retining Corp.	Port Arthur, Tax	1917	17	17	17	17
Biorogine Powder Co. Booker Electrochemical Co.	Hopewell, Va. Niagara Falls, N. Y.	1989	18	10	18	18
Hooker Electrochemical Co	Ningara Falls, N. Y	1888	112.5	100	100	<100
	Tacoma, Wash	1936	50.5	83	88	180 .
Ines Chemical Co	Ningara Falls, N. V.	1912	12	26	25 26	25
Kimberly-Clark	Kimberly, Wis.	1916	.11	26	119	6.119
Kimberly-Clark Mathieson Chemical Corps.	Kimberly, Wu. Niagara Falla, N. Y.	1807	119	119	119	220
Manager Charles Ch.	SMITHIRE, VA.	1951	19	140	140	155
Monomato Chemical Co	Monsanto, III	1932	0.1	0.1	0.1	0.1
Morton Salt Co.	Manistee, Mich	1984	0.1	1.7	1.7	1.2
National Load Co	Sayreville, N. J. Niagara Falla, N. Y.	1901	60.5	95	96	130
Niagara Alkali Co. New York & Pa. Co.	Johnson burg, Pa.	1914	13	18	13	13
Oxford Pager Co.	Rumford, Me	1916	13.5	18.5	13.5	13.5
Pennsylvania fialt Mfg. Co	Portland, Ore	1947	20.0	48	45	72
	Tacona Week	1928	39	67	67	90
	Tacoma, Wash	1906	78	197	197	205
Peroberts Cheminal Fibre Co	Great Works, Me.	1906	7	7	7	7
Pittleburgh Plate Gleen Co. M	Barberton, Ohio	1996	112.5	172	173	300
F	Barberton, Ohio New Martinaville, W. Va	1943	-	298	290	345
Sulvay Pressus Division	Baton Rouge, La	1997	47	:00	60	60
	Hontoville, Ala.	1943	-	110	110	110
	Syracuse, N. Y	1943	61	72	72	180
Southern Advance Bug & Paper Co	Hodge, La. Corpus Christi, Tex.	1986	18.5	13.5	13.5	13.5
Southern Alkali Corp	Corpus Christi, Tex	1988	30	70	70	80
	Loke Charles, La	1947	-	300	370	445
Stauffer Chemical Co	Las Vegas, Nev	1942	22.5	170	170	170
Texas Carbon Industries	Sayre, Okla	1994	1.4	1.4	1.4	1.4
8. D. Warren Co.	Cumberland Milla, Mo	1805	2.4	1.4	0.0	18
Westwace Chemical Division	S. Charleston, W. Va.	1995	249	540	380	200
W. Va. Pulp & Paper Ca	Covington, Va.	1917	11	11	11	11
	Lake Md	1917	- 4	6	- 0	6
	Luke, Md. Mochanieville, N. Y.	1917	18	16	15	15
	Tyrone, Pa.	1917	6	6	6	. 6
Wrandette Chenical Gera's	Wyandatta Mish	1908	56	295	205	205
Benite Presideta Corp	Wyandette, Mish. New Brunewick, N. J.	1990	< 5	<8	<8	<5
Other		1000	24.87	201		-
100			1,960	8,275.3	5,377.39	6,978.33
					- Jacob	*******

Dates represent when plant first made chlorine or when completed without regard to ownership. \*1940 values after T. P. Hou, Man ufacture of Soda, p. 329 with minor modifications (rounding); Hou gives total of 1966. 1 t/d; other values are estimates, composite opinion of three members of the chemical industry and three pulp sool paper manufacturers. \*Purchased from Hayden, 1980 and disposition unanexneed. \*Original plant said to be not operating and a runnerse expansion may be at this site — highly conjectural. \*The Chicago plant of uncertain status. \*Plant reported not operating. \*Includes Bells Alkali Co., Bells W. Va., dismandled 1980, cap.—20 t/d; accludes Bryant & Clark. Southpate. Cal., cap. 5.5 t/d. Zapacity is close to 5.5M t/d indicating errors of minus 223 \*New chloring manufacturers parted to be 1200 t/d, equivalent to 1333 t caustin; the 1951-80 difference shown in 1601 t, high by 268 t but off-oot is most part by

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COMMODITY SURVEY, cont. . .

Circumstances placed the advantage with the chlorine producers and the availability of the surplus co-product could not be denied. Makers of ammonia-soda entered the field—Solvay Process Div. in 1927; Diamond Alkali Co., two years later; Columbia Chemicals Div. in 1938 followed by Wyandotte Chemical Corp. at Wyandotte, Mich.

There were other significant developments in these early years which increased the need for caustic. Among them may be cited the DuPont Cellophane Co. which began in 1924. The rapid development of the automobile furnished another outlet. Caustic was used in increasing amounts in petroleum and in the reclamation of rubber.

Within a few years as much caustic was consumed in the new products as in soap. The dominant position enjoyed by soap 20 years ago has been reduced to 5 percent of the total. In

addition, the share of the supply contributed by electrolytic cells has continued to grow and amounts today to three quarters of all the caustic made.

The combination of growing markets and the substantial equivalence in quality of caustic obtained from the two sources leads to an unusual situation. The amount of chlorine which is made determines the availability of electrolytic caustic. The additional quantity is in effect then supplied by the chemical process.

With a domestic electrolytic capacity in 1950 of about two million tons per year, Dow is the largest producer with about 25 percent. Diamond is second with nearly 10 percent and Pittsburgh Plate Glass Co. and Southern Alkali Corp. are tied for third place with 8 percent each. The anticipated capacity in 1951 of 2.5 million tons per year will see Dow in a slightly stronger position with the others continuing with nearly the same share.

#### Caustie Soda: Consumption by Major Industries \*

Unit:	1,000	short to	ns of	100 percent	NaOH	1		
	1948	1948	1947	1946	1945	1944	1943	1939
Chemicals Chemicals Chemicals Chemicals Chemicals Chemicals Chemical Chemical Chemical Cape, cleanton Cape, cle	145 680 160 500 130 90 21 22 170 147	154 720 170 500 130 100 26 21 176 167	186 610 180 488 120 105 27 20 160 126	90 405 180 408 110 104 26 18 110 363	108 400 1145 377 115 100 26 18 105 363	125 390 140 345 110 110 28 18 100 400	105 300 130 330 100 120 24 19 95 \$10	100 187 60 190 44 44 18 17 47 143
Exports	165	198	138	1 640 1	93	121	1.783	1 025

<sup>\*</sup> Chemical Engineering. † Included under miscellaneou

#### Caustie Soda: Supply, Capacity & Price

Unit: 1,000 short tong of 100 percent NaOH Production 1 Lime-Soda Einstrolytic Exports Total 8.90 4.40 3.19 5.03 3.83 19 405.7° 513.4 256.1 137.7 540 S 98 18 26K 0 149 1 75. K 122.4 141.5 216.2° 206.8° 277.1° 268.6° 338.6° 496.9° 311.1° 743.3 126.2 63.2 163.6 121.4 92.0 32 36 42 42 43 989 1,115 1,182 1,129 1,478 137.0 134.10 73.8

<sup>1</sup> Total production plus set imports-exports. <sup>1</sup> 1917-21: Census of Manufactures and Mineral Resources: 1923-39: Census of Manufactures except as noted; 1941-: Facts for Industry, series M19A and Supplements. <sup>1</sup> 1918-46: U. S. Ferviga Commerce & Narigation; 1946-: Report No. FT 410; inports small, 791 tons in 1921, otherwise: <221 tons (1939). <sup>4</sup> Operating capacity as installed at year end; values approximate only; 1919 and 1921, trade estimates; 1939. Chemical & Medallumpina Regiscerors; 1917-30.5M tons given by R. L. Murry, Frons. Am. Inst. Ch. Eng., 30, 445, 1940; however, expansion exceeded the 1949-29: Wholesale prices, 75 percent, works; 1931-39: 76 percent works; Bursau of Labor Statistics; 1941-: ammonia process, 76 percent, works; 1931-39: 76 percent works; Bursau of Labor Statistics; 1941-: ammonia process, 76 percent, percent, works; Dureau of Labor Statistics. Exclusives of causatic for soap manufacture. <sup>7</sup> As reported by Federal Fower Commission & differs from Consus. <sup>8</sup> Greater than Census. <sup>9</sup> July-Aug. rate used fee the quarter.

STREET.



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## New Construction

#### Proposed Work

- La., Baton Rouge—Ideal Cement Co., Baton Rouge, plans to construct a cement plant. Estimated cost \$4,000,000
- Mich., Port Huron.—Premiet Pulp & Paper Co., of Cariada, Sarnia, Ont., Cam., plans to construct a paper processing plant here to include a pipe line to carry pulp slush under St. Clair River from Canada. Estimated cost \$10,000,000
- Tex., Beaumont—Texas Gulf Sulphur Co., Beaumont, plans to construct a sulphur mining plant. Estimated cost \$5,000,000
- Tex., McAllen—Taylor Mayfair Interests, McAllen, plans to enlarge its recycling plant. Estimated cost \$2,750,000
- Tex., Texas City—Pan-American Refining Corp., Texas City, plans to expand the Panarez unit in its chemical plant. Estimated cost \$2,000,000
- Wash, Tacoma—Hooker Electrochemical Co., Niagara Falls, N. Y., plans to construct a anhydrous ammonia plant here. Estimated cost \$2,000,000

#### Contracts Awarded

- Calif., Los Angeles—Union Oil Co. of Califormia, 617 West 7th St., has awarded the contract for a fluid catalytic unit at its refinery to Arthur G. McKee & Co., 2300 Chester Ave., Cleveland, O. Estimated cost \$500,000.
- Calif., Los Nietos—Pacific Clay Products Co., Los Nietos, has awarded the contract for reconstructing its factory to The Contracting Engineers, 23104 West Verson Ave., Los Angeles. Estimated cost \$600,000
- Ga., East Point—Pittsburgh Plate Glass Co., c/o Robert & Co., Assoc. Archts., 96 Poplar St., N. W., Atlants., has awarded the contract for a paint and varnish manufacturing plant to Ira H. Haddin Co., Zahner Bldg., Atlants. Estimated cost \$1,000,000
- III., Chicago—Arrow Petroleum Co., 51st St. and Harlem Ave., has awarded the contract for a tank and office building to Klefstad Engineering Co., 3450 North Kostner Ave., at \$220,000
- Ill., Chicago—Dryden Rubber Co., 1100 South Kildare St., has awarded the contract for plant additions to John Griffiths & Son Construction Co., 228 North LaSalle St., at \$135,000
- Ill., Stickney Twp. (Chicago P. O.)—Charles Eneu Johnson, 5005 South Munson St., has awarded the contract for an ink manufacturing plant to Clearing Industrial District, 38 South Dearborn St., Chicago. Estimated cost \$150.00
- Kan., Kansas City Colgate-Palmolive-Peet Co., 105 Hudson St., Kearny, N. J., has awarded the contract for an addition to its soap manufacturing plant to S. Patti Construction Co., 1340 Admiral St., Kansas City, Mo. Estimated cost \$1,000,000
- Kan., Kansas City-Procter & Gamble, 19th and Kansas Sts., has awarded the contract for detergent plant units on 10 acre tract

	- Current Projects		Proposed	tive 1950
	Work	Contracts	Work	Contracts
New England Middle Atlantie South Middle West Wost of Minimispi Far West Canada	\$4,000,000 10,000,000 9,750,000 2,000,000	\$3,895,000 2,435,000 748,000 6,092,000 1,350,000	\$4,100,000 \$2,510,000 83,768,000 21,426,000 118,250,000 23,236,000 21,926,000	\$2,722,000 38,710,000 384,324,000 59,752,000 153,416,000 18,841,000 41,198,000
Total	\$25,750,000	\$14,320,000	\$275,216,000	\$548,963,000

- near present plant to Day & Zimmerman, Inc., Packard Bldg., Philadelphia, Pa. Estimated cost \$1,000,000
- Ky., Paducah.—U. S. Atomic Energy Comn., 1901 Constitution Ave., N. W., Wash., D. C., has awarded the contract for a plant to produce U-235 by gaseous diffusion process to F. H. McGraw & Co., 51 East 42A0 5t., New York 17, N. Y. Total estimated cost approximately \$500,000,000.
- Mo., St. Louis—Phelan-Faust Paint Mfg. Co., 932 Loughborough St., has awarded the contract for a 3 story manufacturing plant to Frain-Colnon Contracting Co., 1706 Olive St.
- Mo., Webster Groves—Tret-O-Lite Co., 937
  East Pacific Ave., has awarded the contract
  for a chemical plant, 10,000 sq. ft. space,
  to Win. H. & Nelson Cunliff Co., 3320
  Lindell Blvd., St. Louis.
- Neb., Omaha—Quaker Outs Co., 2811 Dodge St., has awarded the contract for a chemical plant to Parsons Construction Co., 512 Crain Exchange. Estimated cost \$1,000,000
- N. J., Berlin—Owens-Illinois Glass Co., Ohio Bldg., Toledo, O., has awarded the contract for a 1 story, 120x281 ft. warehouse to Hughes-Foulkrod Co., 1505 Race St., Philadelphia. Estimated cost will exceed \$82,000
- N. J., Riverside—B. F. Goodrich Co., 500 South Main St., Akron, O., has awarded the contract for alterations and addition to its plant to John S. McQuade, Jr., 1318 Parish St., Philadelphia, Pa., at \$155,656.
- N. Y., Pearl Rivet—American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y., has awarded the contract for a 6 story, 160x190 ft. pharmaceutical plant to Thompson-Starret Co., Inc., 444 Madison Ave., New York, N. Y.
- N. Y., Rochester—Fort Wayne Corrugated Paper Co., 130 East Douglas St., Fort Wayne, Ind., has awarded the contract for a 1 story paper converting plant to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost \$1,250,00
- O., Toledo—Glass Fibers, Inc., 6050 River Rd., has awarded the contract for a factory to Paul G. Peters Co., 2318 Monroe St., Toledo. Estimated cost \$243,000
- Pa., Chester—Scott Paper Co., foot of Market St., has awarded the contract for a bleach plant addition to David M. Hunt, 112 South 16th St., Philadelphia. Estimated coat \$82,-000
- Pa., Norristown-Philadelphia Asbestos Co., Stanbridge St., has awarded the contract

- for a factory to Paul G. Peters Co., 2318 Monroe St., Toledo. Estimated cost \$243,-
- Pa., Philadelphia—Rohm & Haas Co., 222 West Washington Sq., will construct a laboratory addition. Work will be done with separate contracts. Estimated cost will exceed \$82,000
- S. C., Aiken—U. S. Atomic Energy Counn., 1901 Constitution Ave., N. W., Wash., D. C., has awarded the contract to build and operate a plant to produce tritium for H-bombs to E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del. Estimated cost \$260,000,000
- Tenn., Chattanooga—Cutter Laboratories, c/o Austin Co., contractors, 16112 Euclid Ave., Cleveland, O., will construct a manufacturing plant. Estimated cost \$1,000,000
- Tenn., Knoxville—Volunteer Portland Cement Co., Cement Plant Rd., will construct a plant addition. Work will be done by owner. Estimated cost \$135,000
- Tex., Abilene—Onyx Refining Co., Abilene, will construct a thermal cracking unit. Work will be done by force account and sub-contracts. Estimated cost \$285,000
- Tex., Carthage—United Gas Pipe Line Co., 1526 Fairfield St., Shreveport, La., will construct a 2,000 hp. compressor station. Work will be done by owners. Estimated cost \$275,000
- Tex., Corpus Christi—Taylor Refining Co., Taylor, will modernize and enlarge its refinery here. Work will be done by owners under supervision of Socony-Vacuum Oil Co., Inc., Engineering Dept. Estimated cost \$1,400,000
- Tex., Houston—Kolker Chemical Works, Haden Rd., will construct a D.D.T. chemical manufacturing plant. Work will be done by owners with sub-contracts. Estimated cost \$100,000
- Tex., Houston—Shell Chemical Co., Shell Bidg., will construct a denaturing Ethelyn alcohol unit, also a proprietary solvent plant unit. Work will be done by owners with sub-contracts. Estimated cost \$650,000 and \$200,000 respectively.
- Utah, Salt Lake City—Utah Fire Clay Co., 1078 S. W. First St., will construct a new kiln, drier and preheater. Work will be done with company forces. Estimated cost \$250,000
- W. Va., St. Marya—Calco Chemical Co., St. Marys, has awarded the contract for an addition to Willow Island plant to Wilson Bros. Construction Co., 34th and Emerson Sts., Parkersburg. Estimated cost \$300,000



Where leakless operation of rotary shafts on pumps or other equipment is required, Garlock Mechanical Seals will do the job.

There is no wear on the shaft when a Garlock seal is used. Sealing is effected by leakless and positive contact between carefully lapped metal-to-carbon or metal-to-metal mating surfaces. One of these elements rotates with the shaft and the other is stationary. The stationary element does not contact the shaft.

These precision-built seals are made in several standard designs and in a wide range of highest grade materials. The selection of design and materials depends upon the service in which the seal is to be used. If none of our standard designs appears entirely suitable for any specific application, a modification of a standard design or a specially designed seal will be engineered and built for that job.

Thousands of Garlock Mechanical Seals have proved their effectiveness, durability and economy on shafts operating at high and low speeds and pressures. Users of Garlock seals are enjoying many months—or years—of trouble-free operation on equipment handling various liquids such as, for example, water, gasoline, beer, acids and paint.

If you need Mechanical Seals for any kind of a rotary shaft application, let Garlock's experienced engineering staff work with you. Write for our Mechanical Seal booklet.

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GARLOCK

# ANSWEIS to tough piping, hose and conduit problems can be simple



# Hazardous? And how!

Open wiring in grain ele-vators is forbidden by code requirements. But rigid conduit from switch to motor in this installation would prevent necessary adjustment of the motor drive. SEALTITE\* (American Flexible Metal Hose with an impermeable synthetic covering) offered the ideal solution -combining complete safety with flexibility. Photo courtesy Produce Terminal Corporation, Union Stock Yards, Chicago, Ill.



# Gulps Grit

The American Flexible Metal Hose shown on this big grinder has plenty of grit—gulps it regularly. It can take it, too, because it's plenty tough as well as flexible. That's a combination of special value in many a job for which this versatile hose should be considered. Photo courtesy Simmons Ma-chine Tool Corporation, Albany, New York.

# Ideal for Innumerable uses

American Flexible Metal Hose and Tubing are made in an extensive variety of styles and metals for conveying liquids, many chemicals, air, steam, vapors, oils, greases, gases and semisolids, under severe conditions of corrosion, temperature, pressure and mechanical stress; for protecting wiring and flexible drive shafts; and for connecting piping or ports that vibrate, move, or are out of alignment. For information on any type of American Flexible Metal Hose and Tubing-or for help in special problems-write to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.



A Neat "Settlement" They wanted the feed wires to this transformer in conduit. But they expected a settling action might occur which would put a dangerous strain on rigid conduit. So they used SEALTITE\*, combining flexibility with complete protection. A neat settle-

ment of a common problem. Photo courtesy Pacific Gas & Electric Company, San Francisco, Calif.

Wherever connectors must move



American Flexible METAL HOSE AND TUBING



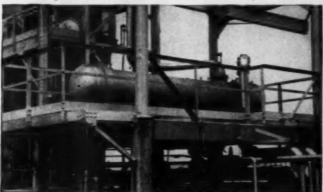
# BRIDGEPORT BRASS COMPANY

CONDENSER TURE EDITION

# COPPER ALLOY BULLETIN

\*Bridgeport

"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. - IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Overhead Condenser in large eastern refinery equipped with Duplex tubingsteel outside. Admiralty inside.

# Have You Considered Duplex Tubes — for Increased Service Life?

Are all engineers fully aware of the possibilities of Duplex tubes for longer service life and better heat transfer? Some who have tried them only recently regret that they had waited so long before receiving their benefits.

Duplex or double-walled tubing of two entirely different metals was developed to overcome difficult corrosion problems that cannot be readily solved by the use of single-walled tubes.

No doubt the outstanding classical example of the superiority of Duplex tubing is its use in connection with ammonia. For years the maintenance and replacement of steel in refrigeration piping in ammonia systems was a serious one. The steel was attacked by rusting on the water or brine side but it was very satisfactory on the ammonia side. On the other hand, copper and brass which possess excellent resistance to corrosion from water are unsatisfactory in contact with ammonia. Consequently, Duplex tubes with steel to the ammonia side and copper to the water side are ideal for this application.

Not only has freedom from rusting eliminated periodic cleaning and frequent replacement, but the higher heat transfer properties of copper/steel Duplex as compared to steel piping, often results in lower power costs for pumping. On new equipment the greater heat transfer rate permits the use of less tubing and corresponding reduction in size of equipment. Duplex tubes (copper/steel) are also widely used in heat exchange equipment for the manufacture and handling of amino compounds which behave similar to ammonia solutions from a corrosion standpoint.

### Ammonia in Product

Ammonia even in small amounts, found in petroleum products produced during processing or intentionally added to neutralize acidic substances, sometimes gives trouble to brass tubing —Admiralty, aluminum brass, or Muntz metal. Some refineries have switched to cupro-nickel (70-30) and report about twice the life of Admiralty in this service. Duplex tubing with plain low carbon steel or Type 304 stainless steel on one side and copper or a copper-base alloy is often satisfactory for this condition.

### Sulphur in Product

Hydrogen sulphide and other sulphur compounds present in some petroleum liquids or gases, are very corrosive to copper and high copper alloys. A brass tube alloy such as Muntz metal which contains about 60% copper and 40% zinc or Admiralty are appreciably more satisfactory than the higher copper alloys. Steel sometimes stands up better, from the oil or gas side, than the copper-base alloys, but rusts or corrodes from the water side. Here in many instances Duplex Tubing—steel to the petroleum side and Admiralty, Cupro Nickel or brass to the water side—is working out very satisfactorily.

### Other Applications

There are many places where Duplex Tubes will outlast single-wall tubing. Consequently, they should be considered if only in the interest of conserving metals.

Lube Oil Coolers—used in manufacturing lubricating oils or in cooling oils in diesel engines, turbines, motors. Duplex-aluminum outside—copper inside —replace either copper or steel tubing.

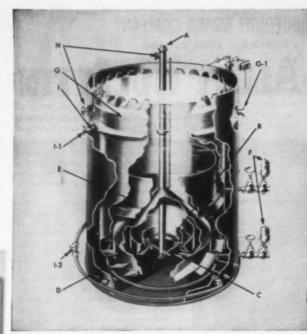
Fuel Oil Heaters — thinning down heavy fuel oil previous to being atomized and burned. Duplex—copper outside, steel inside.

Cyanides-Organic or Inorganic-for chemical operations involving these chemicals. Duplex with steel outside and copper inside is recommended.

Boiler Duplex Tubes, Steam Generators – replacing ordinary steel boiler tubing in the rebuilding and construction of boilers and generators. The copper is surrounded by water in Duplex—copper outside, steel inside. Hot gases are in contact with the steel.

Hot Sulphuric Acid Solutions—heating or cooling sulphuric acid solutions. Duplex—lead outside, copper inside to the steam side or cooling water.

Much technical information on Duplex tubes—combinations of metals and the applications and methods of installing—can be found in the Duplex Tubing Technical Bulletin No. 1950. Write for your copy. If you have a serious corrosion problem involving tubing, please fill out the questionnaire on page 2 of the aforementioned bulletin and send it to our nearest office. Our Laboratory may already have information which has solved a similar problem. (6157)





Jorian the Worthington Cold Process Sturry Type Pre-ipitation Water Softener and Coggulator.

REACTION TANK of Worthington Starry Type offener (Starry bed eliminated for clarity). (A) Raw offener (Starry bed eliminated for clarity). (A) Raw observance of the continuation (C) Chemical Applicators. (D) Starry bed vitionate sludge removal. (G) Collector through for interest with the continuation of t

# This slurry bed stays put! ... and troublesome variables are out

WORTHINGTON SLURRY TYPE PRECIPITATING WATER SOFTENER AND COAGULATOR gives consistent, uniformly softened water

If it's clear, uniformly softened water you want, this unique Worthington Water Softener is just what you need. Concentrated quick mixing and

rapid recirculation of applied chemicals and raw water, achieved by bydraulic energy instead of submerged mechanical moving parts, is an important, progressive development in the water treatment field.

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Features Give You The Uniformity You Want

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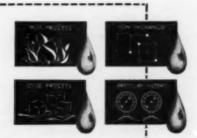
Worthington engineers all four water conditioning processes; therefore, can give you unbiased recommendations on which process is right for you . . . further proof that there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.

# WORTHINGTON



WATER CONDITIONING

on Makes More of the Equipment for All Types of Water Conditio



If you're all gummed up'

in a tough heat transfer problem

Vogt Spiral, Spring Type Scraper Patent, No. 2,117,175

Vogt SCRAPER S TYPE CHILLERS

Fouling of the inner pipe surfaces of Vogt Chillers is eliminated, because they are swept clean continuously during operation by patented spiral, spring type scrapers. And these clean surfaces achieve the highest possible rate of heat transfer between the solution and the refrigerant.

VOGT DOUBLE PIPE TYPE CHILLERS are designed to use ammonia, brine, or cold dewaxed oil as the cooling medium. Oil or brine, when employed, is circulated through the jacket pipes countercurrent to the flow of the solution in the inner pipes.

MULTI-PIPE TYPE CHILLERS, for direct expansion, have large jacket shells each containing seven inner pipe sections and employ volatile refrigerants such as ammonia, freon, propane, etc.

Our engineering staff is qualified by training and experience to help you find the right answers to your heat transfer problems. Their recommendations are available without obligation.



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bly without driving motor.

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# CMH REX-TUBE

# Interlocked Flexible Metal Hose

IF you convey steam, tar, asphalt, vegetable oils, hydrocarbons or similar substances between relatively movable parts, CMH REXTUBE Type RT-15 flexible metal hose does the job economically and dependably. REXTUBE Type RT-15 combines the long life and durability of metal with an exceptionally high degree of flexibility. Further, it is nonaging, non-contaminating and non-collapsible.

REX-TUBE Type RT-15 is of fully interlocked design in bronze or steel with asbestos packing. (See cross-section above.) Suitable for temperatures up to 600° F; pressures to 500 psi. Sizes range from ½" I.D. through 12" I.D.

Data sheets including specifications are available on request. Write, today!



Tube Type RT-15 being used to steam out a storage take. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Buttom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

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They can help you save 5 to 20% over the cost of mechanical refrigeration, if you have live or exhaust steam available, and require moderate chilled water temperatures from 35° to 65°F. Purchase price is lower, because units are standardized in a wide range of sizes. Installation costs less. And — most important of all — long range maintenance cost is lower. There are no moving parts in the system except the chilled water pump.

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The great and growing Versene family now has seven members. All of them are powerful organic complexing agents. All of them control cations in solution. All of them solve problems in metallic ion contamination . . . But only one (the right one) can do your job efficiently. This is why it's important for you to select the Versene best suited to solving your own particular problem,

### **VERSENES\* ARE VERSATILE**

So versatile are the Versenes that they can help you in almost any metallic ion contamination problem. They give exacting chemical control of troublesome cations by keeping them in soluble complex form. They are extremely efficient and amazingly stable at high temperatures and at all pH s. Investigate them now. Write Dept. B.

Send for samples and ask for Technical Bulletin No. 2. A clue to your problem will put a generation of experience in pioneering the polyamines at your command.

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(the original Versene) is the sodium salt of ethylene-diamine-tetra-acetic acid. It is available in solution or dry form. It inactivates all metallic ions but is not a specific for complexing iron.

VERSENE Fe3 SPECIFIC

is the most powerful complexing agent known for iron in the normal pH range. It also chelates copper, nickel and cobalt.

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Fe3 Specific. It complexes both iron and
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complexes ferric and divalent metal ions including hard water salts in concentrated caustic solutions.

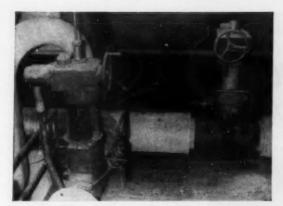
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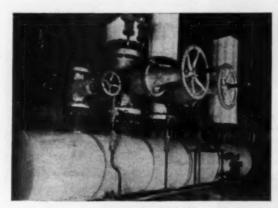
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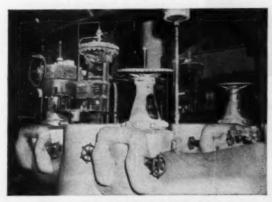
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Walworth Motor Operated Series 900 Pressure-Seal Cast Steel Gate Valves



Walworth Series 600 Pressure-Seal Cast Steel Gate Valves.



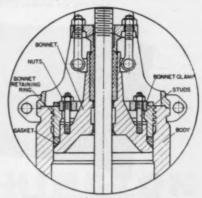
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Walworth Pressure-Seal Valves are easy to disassemble and assemble, and are the most satisfactory valves for high-pressure, high-temperature service. They are available in Series 600, 900, and 1500 and in a wide range of sizes and types. For further information, see your nearest Walworth Distributor, or write: Walworth Company, 60 East 42nd Street, New York 17, N. Y.



A cross section of the bonnet joint assembly of a Walworth Pressure-Seal Cast Steel Gate Volve. The internal pressure is utilized to make the body-

# *w*alworth valves and fittings 60 EAST 42nd STREET, NEW YORK 17, N. Y.

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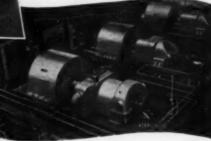
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# In steel plants

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This 1910 hp, 17,800 cfm De Laval Turbine Driven Blower supplies air for catalyst regeneration in a fluid catalytic cracking plant.

These three De Laval Blast Furnace Blowers serve one of America's leading steel plants—the largest unit is rated at 123,00 cfm against 33.3 psig. The other two are rated at 97,800 cfm each.



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This 35-ft. diameter, 40-ft. high, API standard tank is another example of the many fabrications by Graver... in steel, stainless and alloys.

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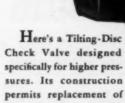
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Has Removable Center Section for Quick and Easy Replacement of Operating Parts



operating parts, if ever necessary, without removal of entire valve from the line. Once the studs between inlet and outlet sections of the body are taken out, the entire center section (containing disc, seating face and hinge pins)

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TILTING-DISC
CHECK VALVES
are evaliable in either
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Important, too, is the smooth, easy operation obtained by the tilting-disc design. The balanced disc is held on the open stops by the velocity of the medium being handled. There's no slamming on closure to cause destructive pipe line stresses.

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The Chapman Valve Mfg. Co.

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# GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS



Your preference for Globe Welding Fittings is supported by a source of supply with exceptional qualifications. Specialized metallurgical experience and facilities gained in years of steel tubing manufacture enable Globe to produce welding fittings by a precision process that yields a superior product.

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### SIZE RANGE OF GLOBE SEAMLESS WELDING FITTINGS





Producers of Globe Seamless Stainless Steel Tubes—Gloweld Welded Stainless Steel Tubes—Carbon—Alloy—Seamless Steel Tubes—Globeiron Seamless High Purity Ingot Iron Tubes and Pipe.

Description of Fitting	Standard Weight (Schedule 40)	Extra Strong (Schedule 80)	(Schedule 160)	Double Extra Strong
Elbows 45° Long Radius	1/2 in. to 24 in.	1/4 in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Long Radius	1/2 in. to 24 in.	% in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Short Radius	1 in. to 24 in.	1½ in. to 24 in.		
Returns 180° Long Radius	½ in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	3 in. to 8 in.
Returns 180° Short Radius	1 in. to 24 in.	1½ in. to 24 in.		
Reducers (Concentric and Eccentric)	1 x 3% in. to 24 x 20 in.	1 x % in. to 24 x 20 in.	1 x % in. to 12 x 10 in.	1 x % in. to 12 x 10 in.
Toes Straight	% in. to 24 in.	% in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Tees Reducing Outlet	34 in. to 24 in.	34 in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Stub Ends Lap Joint	1 in. to 24 in.	1 in. to 24 in.		
Caps	1 in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.

Flanges available 1 inch to 24 inches in all weights



# NO, SIR! The Seal Worit Blow!

DODGE TYPE "SC" BALL BEARING PILLOW BLOCK

Precision built bearing for small shafts and moderate loads. Pillow blocks, flange bearings and hanger bearings available from distributors' stocks in shaft since ranging from 3/4" to 2-7f16".

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained, he can give you valuable assistance on new, cost saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone book.

METALLIC-BACKED neoprene seals are used in this famous bearing—and they are engineered to stay put. They can't blow.

Your lubricant stays in; dust and dirt stay out; the result is years and years of trouble-free performance.

The "SC" Bearing is a new member of the Dodge 30,000 hour line. Modern styling. Rugged one-piece cast iron housing. Long inner race. Radial and thrust load capacity. Fully self aligning. WRITE for special "SC" bulletin, giving complete specifications.

CHICAGO THRIFT ETCHING CORPORATION 1555 N. Shoffield Ave., Chicago, III.

DODGE

of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

Constructed to Take Severe Punishment

Without Tube Swelling



Tube Securely Locked by Special Stainless Steel Inner Wire Braid!

Illustration above shows how exclusive inner stainless steel braid of CONCORD #20 Steam Hose prevents tube swelling and assures long life under severe use.

CONCORD #20 STEAM HOSE

Here's the steam hose with a structural difference that eliminates... once and for all... the common failure of tube swelling under continuous high pressure operation.

CONCORD #20 Steam Hose gives you the exclusive protection of a tough inner lining . . . a lining of stainless steel wire braid. This braid assures permanent retention of the original inside hose diameter. It prevents swelling and constriction of the tube . . . assures full flow of steam at all times . . . permits re-coupling in the field when necessary, without the slightest difficulty.

In addition, CONCORD #20 construction features include: two or three braids (depending on size) of alternate high tensile steel wire and rubber layers are firmly bonded over the outside of the tube. They provide maximum burst-protection and safety. An asbestos braid provides positive cover adhesion and serves as cover insulator. On top of all is the rugged, abrasion-resistant cover that withstands the severest abuse.

Flexible, tough and dependable...that's BWH's new CONCORD #20! Ask your nearby BWH distributor for a demonstration. Get in touch with him today, or write us direct.

> Distributed by: MAHONEY-CLARKE, Inc., 217 Pesri St., New York 7, N. Y. Tel: WHiteball 3-0750

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT, CAMBRIDGE, MASS. . P. O. BOX 1071, BOSTON 3, MASS., U. S. A.



An Important Message For Everyone Who Has an Industrial Waste Problem

# If Your Liquid Wastes Can Be Treated INFILCO Equipment and Experience Can Solve Your Problem!

DEMONSTRATED PERFORMANCE . . INFILCO equipped plants in several process industries are working at peak efficiency, treating a wide variety of industrial wastes. That's the proof that iNFILCO equipment can handle your problem.

DIVERSIFIED EQUIPMENT . . INFILCO manufactures the most complete line of equipment for chemical or biological treatment-your assurance of unbiased recommendations and unified responsibility for performance.

DEVELOPMENT LEADER . . INFILCO'S staff of engineers and chemists have the experience from investigating and solving scores of disposal problems to assist in finding the solution for your liquid waste disposal.

Call in the nearest INFILCO Field Engineer for a more detailed picture of waste treatment equipment for your company. There is no obligation to buy-just an obligation to yourself to investigate the better products and services of the leader. Write our Tucson Executive Offices today... ask for INFILCO Bulletin No. 70A.

SERVING INDUSTRY WITH WASTE TREATMENT EQUIPMENT THAT'S

<u>Quality</u> Engineered for <u>Quality</u> Performance

PARTIAL LIST OF RECENT INFILCO INDUSTRIAL WASTE TREATMENT PLANTS

General Electric Co. Ranco, Inc.

Taylor Fibre Co.

New Deporture Division General Motors Corp. River Raisin Paper Co. Horristown Magnesia & Asbestos Co. Spring City Bleach & Dye Works

Sendusky, Ohio Monroe, Mich. Harristown, Pa. Spring City, Po. Betzwood, Po.

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ACCELATORS

Electric Autolite Co. Magnelia Petroleum Co. Clark Equipment Co. Rock Island Refining Co. Public Service Electric & Gas Co. General American Transportation Co. East Chicago, Ind. Rapid City Air Base Searle Food Corp.

Lockland, Ohio Framont, Texas Jockson, Mich. Zionsville, Ind. Jersey City, N. J Weaver, S. D. Uleta, Florida

BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE



View of Harbor Island Laboratory and Testing Station.

# New testing station provides expanded facilities for corrosion studies

During the past 15 years, the Atlantic Ocean at Kure Beach served as a giant test tube for studying attacks of sea water and salt air upon more than 35,000 specimens, including virtually all types of metals and alloys.

Storm damage to the basin, in which the underwater tests were conducted, compelled establishment of a new and protected testing station. Accordingly, some 15 miles north, on Harbor Island, the new Inco Marine Laboratory was built to provide expanded facilities and an even better "Ocean Test Tube."

This new Harbor Island station, along with the atmospheric test racks retained on the shore of Kure Beach, now widen the scope of cooperative enterprise for fighting industry's common enemy — corrosion.

The vast amount of valuable data accumulated over the years will continue to be made available to all industry, as well as to government agencies for whom and with whose cooperation much of the research has been undertaken. You are invited to consult us on your corrosion problems.

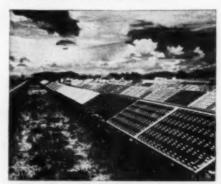




Lowering piling test specimens into place. Sea water is something more than a mixture of chemicals; its corrosive action over an extended period can be studied properly only by exposure of specimens to attack under natural conditions.



Running water troughs. For studying the action of sea water flowing at moderate velocities, specimens are immersed in the troughs, shown above. The total length of trough used for this purpose now amounts to about 600 feet.



Almospheric and spray test lot. Shown above is part of the atmospheric test lot at Kure Beach in which over 20,000 specimens have been exposed, some for over nine years. The racks face south, and the specimens, supported on porcelain insulators, are all set at a slope of 30 degrees.

# THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET, NEW YORK 5, N.Y.

When you're looking for

LEAD VALVES

to control corrosive chemicals

Oxygen
Phenol
Chlorine
Boric Acid
Pyridene C
Naphthalene
Zinc Chloride Phen
Sodium Hydrosulphite
Ammonium Sulphate Diox
Hydrofluoric Acid Carbo
Ferrous Sulphate Alun
Ammonium Phosphate Chrom
Copper Sulphate Titan
Nitrocellulose Phen
Phosphoric Acid

Sulphuric Acid
Sodium Hydroxide Ba
Hydrogen Peroxide Alu
Aluminum Sulphate Bo
Nitroglycerine Hydr
Titanium Sulphate Ch
Sodium Carbonate Di
Sodium Chloride Phes
Sulphur Dioxide Alu
Calcium Carbonate Bi
ite Benzyl Chloride

Sturdiness, dependability, suitability...that's what you want in acid valves, isn't it?

And that's what you get in National Lead's "United" valves—valves made with "St. Joe chemical lead."

Sturdiness: National Lead valves are constructed to withstand stresses and overloads far beyond the demands of regular duty.

Dependability: The leader in lead, National Lead Company has the metal know-how...the acid control know-how...to design valves that make the most of lead's inherent corrosion resistance.

Suitability: To the selection of just the right valve, as well as the right alloys or other materials for critical parts, National Lead Company brings experience that covers the entire processing field.

Sturdiness, dependability, suitability... three good reasons for specifying National Lead's "United" valves. Available in a complete line that includes hard lead and lead-lined flanged acid valves; "Y" and angle patterns, gate, check, foot, and diaphragm valves.

Specify "United" whenever you need valves to control corrosive chemicals.

# ...<u>look</u> to the Leader in Lead

...in everything from lead pipe...valves...sheet...and lead-lined or lead-covered equipment...to complete acid recovery plants.

# NATIONAL

LEAD COMPANY

New York 6; Baltimore 3; Buffalo 3; Chicago 8; Clincinnaii 3; Cleveland 13; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Leval Cempany of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Atlanta (Georgia Leval Works Div. of Cincinnati Branch); Teronto, Canada (Canada Metal Co. Ltd.).



fing. U. E. Pas. O

# Coordinated

# INSTRUMENTATION AND CONTROL by HAGAN

The satisfactory functioning of a system of instrumentation and automatic control requires that the characteristics of each unit of equipment shall be correct for its particular service and that these characteristics shall be coordinated with those of all other related units.

The coordinated equipment developed by Hagan engineers includes pressure measuring and control devices for any range from a few thousandths of an inch water column to 5,000 psig; force measuring devices which will respond to the weight of a dime—or measure the total thrust of a jet bomber; panel type relay units which provide for modification of loadings and for remote manual control; double acting power units in sizes which provide precision control of tiny valves or of heavy slide dampers.

With such a variety of equipment, Hagan engineers can design the system which best meets the requirements of each individual application.

Certain types of installations, for example, are best served by mechanical metering units, with feeler lines connected direct to a self-contained recorder. The Hagan Ring Balance Flow Meter is designed particularly for this type of service.

Standard assemblies are made to measure flow differentials from ½ inch up to 420 inches WC, at static pressures as high as 15,000 psig.

These units may indicate, record and integrate one or two rates of flow. Addition, subtraction and compensation for temperature and pressure conditions may be included. Integration is maintained with high accuracy, even at the lowest flow rates.

Other types of installations may require that meas-

uring elements be located near the primary device, sending pneumatic signals to recorders, as well as to control circuits. For this service, the Ring Balance Transmitter may be used at static pressures up to 15,000 psig and measuring maximum differentials as high as 420 inches WC.

Other types of units for translating pressure differentials into pneumatic signals are designed to serve as line type liquid meters or as differential measuring units in various ranges to a maximum pressure differential of 100 psi at static pressures up to 1,500 psig.

In all except the very simplest control systems, there is specific need for control mechanisms which can combine control signals. Some involve addition or subtraction of signals, while others involve multiplication, division, or even more complicated functions. The Hagan Ratio Totalizer is designed for almost universal application for accurately combining input control pressures and spring forces to produce a single pneumatic output control signal.

The Hagan THRUSTORO, for translating mechanical forces into pneumatic signals for instrument or control circuits, fulfills the exacting requirements of aeronautical and similar testing laboratories.

Other Hagan Automatic Control units are designed for measurement and control of pressure, draft, temperature, engine or turbine speed, fuel-air ratio, damper or valve positioning, and the many other functions which may enter into the final solution of a particular problem.

A letter or a telephone call to the nearest office will enlist at once the coordinated facilities of our engineers in solving *your* problem.

# HAGAN CORPORATION

Hagan Building, Pittsburgh 30, Pa.

Baton Rouge, La. \* Birmingham, Ala. \* Boston, Mass. \* Buffalo, N. Y. \* Charlotte, N. C. \* Chicago, III.

Cincinnati, O. \* Cleveland, O. \* Denver, Colo. \* Detroit, Mich. \* Houston, Texas \* Huntington, W. Va.

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St. Paul, Minn. \* San Francisco, Calif. \* Schenectady, N. Y. \* Toledo, O. \* Warren, Pa. \* Washington, D. C.

IN CANADA — Toronto, Ont. \* Montreal, P. Q. \* Vancouver, B. C.

# From East Texas to South Ohio

A current example of Stone & Webster Engineering Corporation's broad experience in design and construction for the natural gas industry is the six compressor stations on Texas Gas Transmission

Corporation's recently completed



STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

# WHERE you get it ...

DOES make a difference



products, backed by 96 years of successful manufacturing experience

### NEED A COAL-TAR

Hi-Flash Solvent Phenois Phthalic Anhydride

Dibutyl Phthalate Cresylic Acids

Chlorinated Tar Acids **ELASTEX\*** DCHP Plasticizer "ELASTEX" 10-P Plasticizer Xvienals

"ELASTEX" 50-B\* Plasticizer Pickling Inhibitors Benzol "ELASTEX" 28-P Plasticizer

Niacin (Nicotinic Acid) Toluol **Pyridines** 

XvIol **Picolines** Naphthalene

Quinoline

Tar Acid Oils

Neutral Coal-tar Oils

Coal-tar Creosote

CUMAR\* Paracoumarone Indene Resin

Carbonex\* Rubber Compounding Hydrocarbon

Bardol\* Rubber Compounding

Flotation Agents

48er, U. S. Pat. Off.



# THE BARRETT DIVISION

ALLIED CHEMICAL & DYE CORPORATION 40 Rector Street, New York 6, N. Y.



# The Tank Outlet that Won't Leak

The self-priming feature of this dependable LaBour DHL type pump makes the usual outlet connection at the bottom of the tank unnecessary. Corrosive liquids may be drawn out by vacuum through the top of the tank. Since absolutely no piping enters the tank below the fluid level, there are no joints or couplings which might develop leaks.

The York Transport Company of Houston, Texas chose LaBour for this application because of LaBour's rapid self-prime action and known dependability.

LaBour pumps are recognized throughout the chemical industry for their year-in year-out all-around economical, trouble-free service . . . indoors and out.

This installation is only one of many innovations LaBour has on record. Possibly the solution to your most pressing pump problem is already in our files. Write today.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

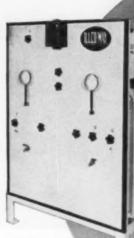
LABOUR



THE LABOUR COMPANY, INC. \* Elkhart, Indiana, U.S.A.

# The <u>Complete</u> Line of "Packaged" DE-IONIZERS

(Righe) Portable Mined-Bad De-ionizer provides treated water with specific resistances up to 15,000,000 ohms These units, with flow rates up to 30 gph, are specifically designed for use in laboratories or wherever small quantities of high purity water are required.



(Aboval Industrial
De-ionizer, one of a
series providing
solids-free water comparable to single-distilled water. Flow rates
up to 1,000 gpb. Shipped
completely assembled with
full accessories for operation
including purity indicator Units
can be furnished with materials for
alics and CO<sub>2</sub> removal. Floor space:
approx 5' x 3' Height approx 7 ft



Industrial
Mixed Bed
Desionizer provides treated
water, with specific resistances
up to 15,000,000
ohms. Shipped completely assembled,
ready for operation,
with full accessories including purity indicator.
Flow rates up to 600 gph.
Floor space 25 x 40" (max.).
Height: approximately 7 ft.

(164) Popular Portable De-ionizer
provides solids-free water comparable
to single-distilled water. Flow rates up to 20
gpb. This versatile model can be furnished
with materials for silica and CO<sub>2</sub> removal.

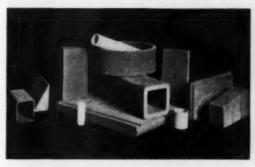
Requirements for pure water in many plants are served by these famous "packaged" units.. quickly available, quickly installed. For greater flow requirements, ILLCO-WAY industrial installations are engineered to provide any flow, any volume on a given water supply. A typical 300 gpm installation is shown at left. Write today for detailed information.

ILLINOIS WATER TREATMENT CO., 844-11 Ceder St., Rockford, Illinois • 7310-B11 Empire State Bldg., New York City

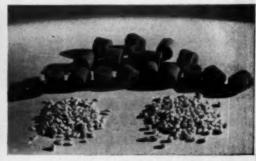


DE-IONIZING DE-ALKALIZING SOFTENING

# Chemical Stability Contributes to Wider Usage of Fused Alumina



REFRACTORY SHAPES, made of Norton Alundum\* mixtures containing 86% to 99.3% fused alumina, resist oxidation in reducing atmospheres at temperatures up to 3450° F. Also highly resistant to chemical attack and mechanical erosion. Write for Bulletin 803.



CATALYST SUPPORTS, made of Norton Alundum mixtures containing 77% to 89% alumina, are highly refractory, chemically inert and extremely durable. Controlled porosity provides wide range of permeabilities and surface areas. Write for experimental samples.



POROUS PLATES AND TUBES made of Norton Alundum grain fired to at least cone 12, are unaffected by acid, neutral and slightly alkaline liquors. They combine uniform permeability with great strength. Write for Bulletin 140.



LABORATORY WARE, made of highly refractory Norton Alundum mixtures containing at least 85% fused alumina (up to 99% in special mixtures), is not attacked by any organic solvent. Write for Bulletin 793.

Investigate! Maybe Norton Alundum shapes can improve your commercial or laboratory processes. The experience of Norton, pioneers in controlling the chemical and physical variables of fused alumina, is at your disposal. Contact your nearby Norton representative or write direct.

NORTON COMPANY, 502 NEW BOND ST., WORCESTER 6, MASS.

\*Trade-Mark Reg. U. S. Pat. Off, and Fareign Countries



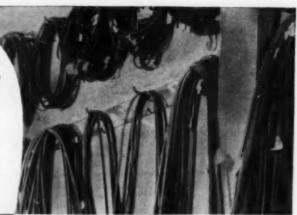
Making better products to make other products better

Special REFRACTORIES

A. F. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

# HERE'S WHERE **VEELOS**SAVES YOU TIME AND MONEY

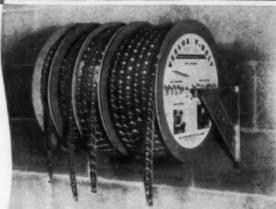
Look at this stockroom with its dangling mess of different sizes of endless v-belts. Here is a typical picture of a costly, hard-to-handle, endless v-belt inventory. With Veelos the adjustable v-belt—all this is ended.



# WITH VEELOS, ANY BELT SIZE IS ALWAYS ON HAND

These four reels of Veelos alone can replace up to 316 sizes of endless v-belts in the O. A. B and C widths. No more stockroom troubles, no more replacement headaches because Veelos is always ready—in the widths you require.

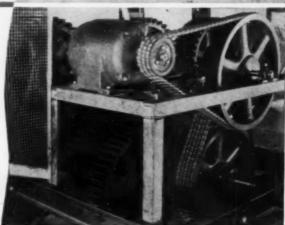
If you are interested in reducing your v-belt costs and increasing your production efficiency, you should have a Veeles Data Book. For free copy of this illustrated book complete with angineering information write<sup>o</sup>



# **VEELOS** ASSURES MAXIMUM MACHINE PRODUCTION

Veelos is easy to install without dismantling outboard bearings. Veelos runs true for vibrationless, full power delivery. Because Veelos is adjustable, uniform belt tension is easily maintained.





### ADJUSTABLE TO ANY LENGTH . ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

\*MANHEIM MANUFACTURING & BELTING COMPANY, MANHEIM, PA.

# PRESENTING . . . THE NEWEST IN PROCESS TEMPERATURE CONTROL





# PYROMETER EQUIPMENT

This General Electric Type HP-3 Pyrometer controls a ribbon-resistor box furnace.

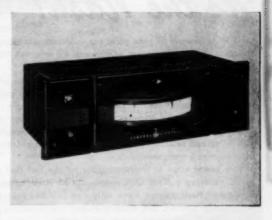
With the introduction of this completely new line of Pyrometer Equipment, General Electric offers you accurate indication and temperature control of furnaces, ovens, kilns, and other industrial-heating equipment.

ACCURATE INDICATION. Calibrated accuracy is within ¾ of 1 per cent of full scale. Automatic cold-junction compensation assures that changes in ambient temperature will not appreciably affect accuracy.

CLOSE TEMPERATURE CONTROL. Any change in temperature equivalent to 1/10 of 1 per cent of full scale starts immediate control action. Normal changes in humidity, ambient temperature, and voltage have little or no effect on the exactness of control action.

DEPENDABLE OPERATION. Substantial industrial components and strong construction throughout make G-E pyrometers exceptionally rugged. A  $3\frac{1}{4}$ -pound alnico magnet provides high flux density and allows large air gaps; lightweight moving system has high resistance to shock and vibration.

For more details, get in touch with your nearest General Electric representative, or write for Bulletin GEA-5534, "G-E Pyrometer Equipment." Apparatus Dept., General Electric Company, Schenectady, N. Y.



General Electric's pyrometer line consists of flush- or surface-mounted indicators, controllers and protectors. Shown above is Type HP-3 two-position indicating controller. A three-position controller is also available.

GENERAL



ELECTRIC



Nash Compressors in your plant can automatically increase the capacity of your absorption equipment, for with the Nash it is possible to secure absorption directly in the pump.

This is due to the Nash liquid compressant operating principle, involving a fluid vortex through which the gas must pass in the process of compression. To absorb from a gas, simply flow absorbent through the compressor as the compressing medium. In this close contact of liquid and gas, the desired fractions are picked up and retained by the absorbent. This in no way impairs efficiency as a compressor.

This useful stunt is made possible by the fact that slugs of liquid entering a Nash Compressor do no harm to the pump structure. Nash pumps have only one internal moving part. simple, non-wearing, and employ no gas contaminating internal lubrication. There are no valves, gears, pistons, or sliding vanes, and original pump efficiency is maintained over a long life. In a single stage Nash Compressors produce 75 lbs. pressure or vacuums to 26 in. of mercury, with capacities up to 6 million cubic feet per day in a single structure. Investigate these pumps now.

One moving part.

No internal wearing parts. No valves, pistons, or sliding vanes.

No internal lubrication.

Low maintenance.

Slugs of liquid entering pump do no harm.

Original performance constant over a long pump life.

Non-pulsating pressure.

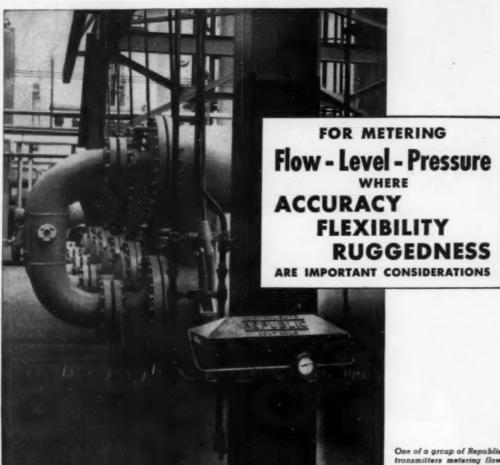
Saves floor space.

75 pounds in a single stage.

316

NASH ENGINEERING COMPANY
304 WILSON, SO. NORWALK, CONN.





One of a group of Republic transmitters metering flow and level in a modern chemical processing plant.

Republic Pneumatic Transmitters are available for measuring flow, liquid level, pressure or liquid density of a wide range of fluids. They employ the force-balance principle to convert these process variables into air pressures which vary proportionally. These air pressures become direct measurements and can be conducted to reading instruments or used as the measuring impulse for the actuation of an automatic controller.

Republic transmitters have a guaranteed accuracy of within 1/2 of 1% of the transmitter range. By making a few minor adjustments or substituting a few small parts, their operation can be easily changed to any desired range between a minimum of 0-0.6" to a maximum of 0-704" of water. Their construction is more like that of a precision machine than of the sensitive instrument they are. Data Book No. 1001 contains complete details — write for your copy.

# REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

# Any filterable mixture handled efficiently at lowest cost

# SPERRY FILTER PRESSES

The plate filter press... the Sperry filter press... is standard equipment wherever filtration is required. These are the reasons why:

Any filterable mixture, including viscous, may be processed.

The filtrate is of maximum clarity.

The cake is drier. The cake is delivered in

slab form.

The cake is thoroughly washed.

The simplest filter cloths may be used.

Paper or pulp may be used as the medium. Precise temperatures may be held.

Hot liquids do not vaporize.

It is easily constructed of acid or alkali resistant materials.

First cost is low. Labor cost for operation is low. The least floor space and headroom is required. Weight per square foot is no greater than other types of filters.

Depreciation is low.

Filtration may be carried out at low, medium or high pressures.

Resale value is high because of wide use. Liquid being filtered need not be exposed to atmosphere.

May be used to separate emulsions. Easily erected by unskilled labor.

May be transported in small pieces. Will deliver filtrate to higher level than

May use wire, wool, nylon, glass, vinyon and other filter cloths.

May use filter paper.

May be furnished in leak-proof construction.

For the application of these advantages to your own filtration problem, call on Sperry today! An analysis of your problem, together with recommendations for its most efficient solution at lowest cost, places you under no obligation.

# D. R. SPERRY & COMPANY BATAVIA, ILLINOIS

Filtration Engineers for Over 50 Years

Bestern Sales Representative: H. E. Jacoby, M.E., 205 E. 42nd S New York 17, N. Y. Phone: Murray Hill 4-3518



Western Sales Rapresentative: B. M. Pilhashy, 833 Merchams Exchange Bidg. Son Francisco 4, Calif.,

# IR:S valv Events

. EXCERPTS FROM THE R-S BOOK OF EXPERIENCE .



# Minimum Pressure Drop

The beveled vane of an R-S Valve seats firmly against the valve body to produce commercially tight shut-off with metal-to-metal seat. A rubber seat produces drip-tight closure. In the open position the streamlined vane creates a Venturi action. Pressure drop in R-S Valves is low, and they therefore produce substantial savings in pumping costs.

Illustration shows a heavy duty R-S Valve used in the water system to a compressor house. Valve is equipped with diaphragm motor, handwheel control with self-locking worm and gear and declutching mechanism together with outboard bearing for operating shaft with goose neck support.

Every R-S Valve is engineered and constructed for rugged service and provided with such safety factors that it will give complete satisfaction in the service for which it is designed. Consult with your local R-S Valve Engineers or write direct.

R-S PRODUCTS CORPORATION 4600 Germantown Avenue Philadelphia 44, Pa.



No. 579—6-inch 15-pound Direct Action Float Valve with counter-weight assembly.



No. 628—Salenoid Trip Velve is used for omergency service. The salenoid can be arranged with the counter-weight mechanism to open or close the velve and held it there in one position or the other. If for any reason the salenoid functions, the latch is tripped, which permits the counter-weight to open or close the valve by gravity. The assembly is suited to shot off the flew or to open a vent and requires manual rest. Can be constructed of any metal or allay and in various sizes for air, gases, steam, oil, hydraulic and other services.



No. 677—1300-pound Welding End Steel Valve for superheated steam service. A.S.M.E. standards with heavy duty hendwheel control.



No. 795—Three-inch 3-way Valve Type No. 733 willizing standard toe and two wafer valves with extended handwheel central.



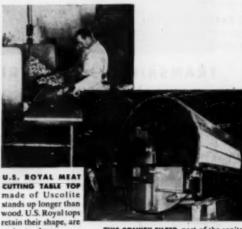


BKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

-manufacturers of BKF and HESS-SMIGHT bearings.

# What's U.S. Rubber doing with Plastic Pipe?

Giving it extremely high impact strength, for one thing. A single .44 cal. revolver bullet, fired at a distance of 20 yards, merely dented this piece of pipe, which is made of U.S. Rubber's new plastic, Uscolite. This amazingly strong, lightweight, versatile piping is easy to handle, won't break if dropped. Furnished in standard lengths, it can be cut to length and threaded on the job. Uscolite is resistant to most chemicals. For more information, write to address below. In Canada, write to the Dominion Rubber Company.



THIS CONKEY FILTER, part of the sanitation system of a midwestern city, is equipped with Uscolite piping. Uscolite handles corrosive acids, alkalies, salts.

UNITED STATES RUBBER COMPANY

# A new concept in Pneumatic Control:

# The Taylor TRANSET\* Control System

- MORE ACCURATE MEASUREMENT
- CLOSER CONTROL ON ANY PROCESS
- CONTINUOUS SPACE-SAVING RECORDS
- ▶ HIGHER PROCESSING EFFICIENCY

Taylor has developed a new controller and a new recorder to take full advantage of faster measuring devices, such as Transaire\* Temperature and Pressure Transmitters and the Aneroid Manometers for Flow and Liquid Level. Each takes advantage of the other's superior performance. Now available in a complete system. The result—unprecedented quality of process control.

- 1. FASTER MEASURING INSTRUMENTS. Taylor's TRANSAIRE, force-balance temperature or pressure transmitters, created new standards in the measurement of changing or dynamic temperatures and pressures. With derivative action (Speed-Acr\*) in the measuring system, they transmit process changes with unbelievably fast accuracy. Many other features.
- FASTER CONTROL with Stability! Taylor's new Tra-Act\* Controller combines a wider range of response adjustments, an increased capacity relay air valve, and a

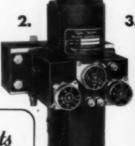
new control circuit, to take advantage of the faster measuring systems. This new force-balance controller permits 4 times faster reset rate and 4 times faster rate action (Pre-Acr<sup>6</sup>) than conventional controllers. No overpeaking. Faster recovery for load changes on pressure, flow, and temperature applications—because rate action is in the new circuit.

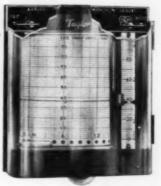
3. MIDGET RECORDER saves space. New Transet Recording Receiver greatly reduces panel space. Fits 37%" x 43/2" panel opening, making it especially adaptable to graphic panels. Gives continuous 30-day process record, with 3 hours visible—remote setting of control point—automatic to manual control—instant check on controller performance and the control valve position.

We sincerely believe this new Taylor-engineered Transet Pneumatic Control System combines the best transmitter, the best controller, and the best recorder on the market. Find out more about it, and put it to work for you! Write for BULLETIN 98097, and ask your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, bumidity, flow and liquid level.

# TRANSAIRE - TO TRI-ACT - TO TRANSET





Taylor Instruments

ACCURACY FIRST

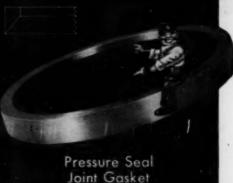
IN HOME AND INDUSTRY

1. TRANSABE force-bulance temperature or pressure transmitter with SPEED-ACT gives rate action in the measuring circuit. 2. TRI-ACT Controller. Has high capacity relay air valve for faster response to new control circuit. Wider response adjustments. 3. TRANSET Recorder. Fizs 5½" x 4½" opening . . a "natural" for graphic panels; a great space saver for conventional panels.

# Need special high pressure gaskets such as these?







# We tailor them to your specifications

If you require high pressure gaskets made to extremely close tolerances—for service exceeding 10,000 psi, for example—and fabricated to any desired diameter or cross-section, why not look into the special service that Goetze offers for making these gaskets to your order.

The gaskets shown above are typical of the wide variety for high pressure service that have been made to order for Goetze customers. The flare type gasket with bellows action illustrated at upper right is but one example of what Goetze "know-how" can accomplish.

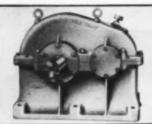
Goetze has had over sixty years of experience in making specialized metallic gaskets for industry's most complex jobs. Modern machines—many of them specially designed and built by Goetze—enable Goetze craftsmen to produce gaskets of any required design, shape or size...and deliver them with remarkable promptness.

For further information about Johns-Manville Goetze gaskets, write for a copy of the new Goetze Gasket Catalog. Or send us a drawing or template for assistance on your specific problem. Address Johns-Manville, Box 290, New York 16, N. Y.



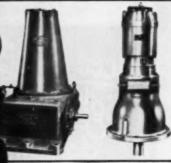
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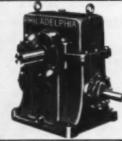
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Your maintenance system, for example!

Unless your maintenance program works on a continuous, preventive basis, you are exposing your business to a major breakdown of equipment! Think what it would cost in lost production . . . lost sales . . . keeping idle workers on your payroll! A preventive maintenance program—developed and installed by Ebasco—prevents shutdown of industrial equipment through a regular inspection schedule adapted to individual plant needs. It regulates the frequency and nature of maintenance work—strikes a balance between too many and too few inspections. It provides for safe equipment and adequate spare equipment. It sees that your records of maintenance are well-correlated and used, instead of being merely filed.

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# **Production Idea**

# from results with rosin

Heat . . . Pressure . . . Corrosion. These three problems are increasingly acute as metal supplies get tighter; new equipment harder to buy, and reconditioning more difficult. But in practically every case, alert equipment builders can find a highly satisfactory answer. This case history, involving rosin production with clad steel equipment, is typical.

Finding the correct solution to tough equipment problems is the job of progressive equipment builders. You'll find many of the best of them applying the Lukenomics principle. For Lukenomics combines their experience and that of designers and engineers with Lukens' specialized knowledge of materials and their application. Such cooperative ingenuity always benefits the ultimate user of equipment. We'll be happy to put you in touch with equipment builders applying the Lukenomics principle. Just write—Manager of Marketing Service, Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.

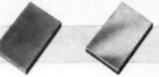
With the defense program having first call on steel products, you will understand why, at present, Lukens specialty steels are not as plentiful as in normal times.

Used in the production of white "premium" rosin, this equipment must prevent product discoloration; withstand alternate heating and cooling; high pressure and vacuum. To prevent corrosion, resist thermal shock and provide structural strength economically, the units were fabricated of Lukens Inconel-Clad Steel. Result: economical volume production of a high-quality product, reduced maintenance, increased profits. By using Inconel-Clad Steel, instead of solid Inconel, the equipment builder effected a 71 % saving of this critical nickel alloy. This is Lukenomics at work



LUKENS STEEL COMPANY











control and clear compustion to preserve pastel color values. Yankee Detroit, Michigan, recently replaced its battery of infra-red lamps with a specially-designed 2-zone Gas-fired oven which finishes top quality fibre tiling rapidly and economically.

The oven has thermostatically controlled zones operating at 275°F and 290°F. Air is heated by direct Gasfired burners, and recirculated from high to low-temperature zone. Masonite tileboards 4' x 8' go through the Gas oven twice, once to bake the primer coat, and again for the enamel finish coat.

To produce 30,000 lbs. a day of Yankee Fibre Tile for bathrooms, in

black, white and a wide range of colors, the manufacturer relies on clean, economical GAS. Gas provides the exact temperatures required, and puts a durable, clean enamel surface on Yankee Fibre Tile. Gas is just as readily adaptable to your special paint

drying or ceramic firing needs. Your Gas Company Representative has the facts. Call him today.

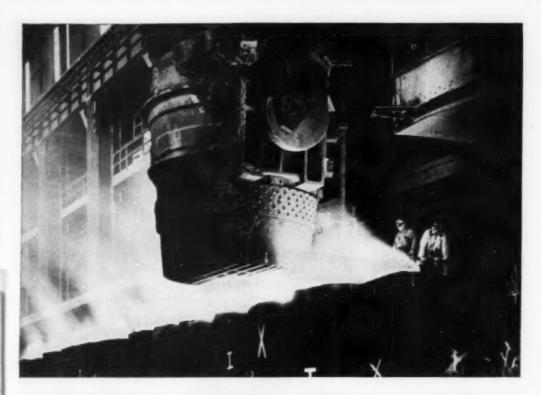


Gas-fired oven built and installed by Young Brothers Co., Cleveland, Ohio

# AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

CHEMICAL ENGINEERING-January 1951



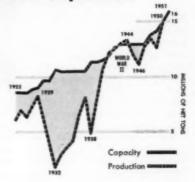
# MILLION TONS MORE STEEL

Latest Increase in Bethlehem's Annual Capacity Climaxes
5 Years of Postwar 3,100,000-Ton Expansion

On January 1 of this year Bethlehem's steel making capacity stood at 16 million ingot-tons annually—an increase of 1 million tons over a year ago.

Since the war ended we have increased our annual steelmaking capacity 3,100,000 tons, or 24 per cent.

Moreover, as the chart at the right shows, Bethlehem's steel capacity has nearly doubled in 25 years. Additional capacity can and will be created as it is needed.



BETHLEHEM STEEL



# caustic salt

Rinse water costs money—especially in the evaporator of an electrolytic caustic plant. The Sharples Super-D-Hydrator, with its completely automatic flexible operation, uses less rinse water to obtain low caustic concentration salt, thus costly steam is saved and the capacity of the evaporator is increased appreciably.

#### Two examples:

(1) On a feed slurry of 12-15% caustic soda, with 35-45% free sodium chloride, the Sharples Super-D-Hydrator produces sodium chloride with 0.15% (max.) caustic soda, and 2% (max.) moisture. Actual records show the use of but 25 gallons of rinse water per ton of dry sodium chloride produced.

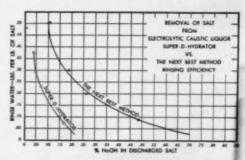
(2) On a 40% caustic soda slurry with 15-25% free sodium chloride, the Super-D-Hydrator produces salt with less than 0.40% caustic soda (max.) and less than 3% moisture—using but 45 gallons of rinse water per ton of sodium chloride produced.

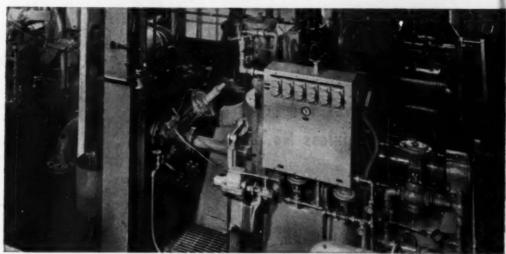
These examples are typical of the high efficiency and economical operation of the Sharples Super-D-Hydrator.

Capacity ranges from 3000 lb./hr. of salt from 40%

caustic mother liquor for the C-20 Super-D-Hydrator, up to 10,000 lb./hr. from 15% caustic mother liquor for the C-27 Super-D-Hydrator.

For caustic salt and dozens of other crystal dehydration applications, the Super-D-Hydrator is the proved best answer to production and economy. Your inquiry will be given our prompt attention.



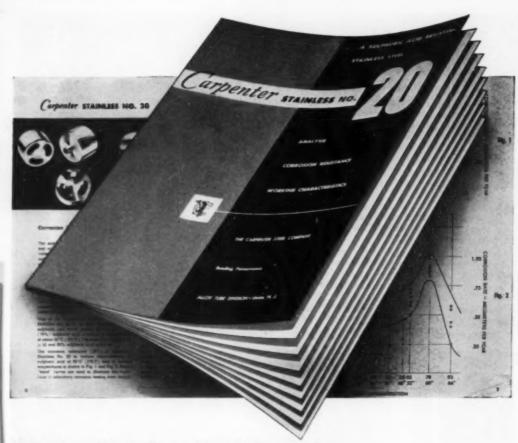


Super-D-Hydrator installation at Pennsylvania Salt Manufacturing Co., Wyandotte, Mich.

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Information on No. 20's electrical and physical properties and its workability is also included. 43 field reports from users of No. 20 show how this Stainless compares with other materials. No. 20's excellent resistance to sulphuric acid at various concentrations and temperatures is described in several of the reports.

A copy of the new Carpenter Stainless No. 20 book will be sent upon request. Just drop us a note on your company letterhead, indicating your title.

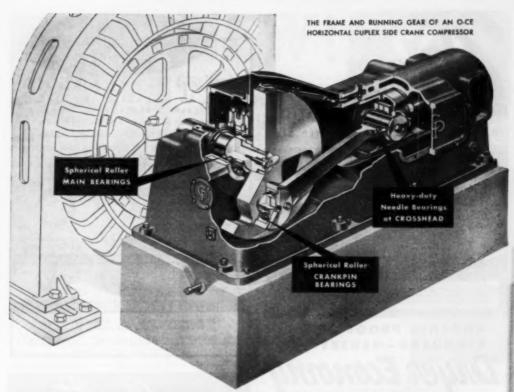
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Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

Write for Bulletin 726-5

CHEMICAL ENGINEERING-January 1951

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- . SPHERICAL ROLLER CRANKPIN BEARINGS
- . HEAVY-DUTY NEEDLE BEARINGS AT CROSSHEAD



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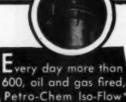
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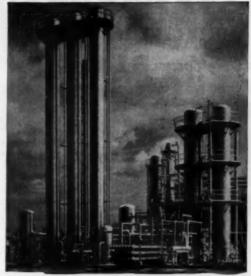
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# **FLORITE**

The recently completed gasoline plant of Southwest Gas Producing Company at Dubach, La., gathers wet gas from the surrounding area and employs new highly efficient methods for separating its ethane and propane components. Ninety million cubic feet of natural gas is handled daily, yielding a daily output of 230,000 gallons of liquefied hydrocarbons. The Fish Engineering Corporation of Houston designed and constructed this model plant.

In the two towers at the right of our illustration, wet gas is dehydrated with Florite and then passed to the three towers at the left for high-

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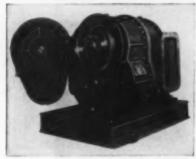
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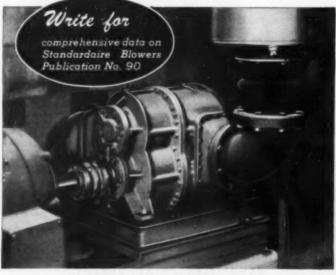
# The STANDARDAIRE PRECISION BUILT Axial Flow BLOWER



Here's another important design feature of the Standardaire Blower HEAT TREATED ALLOY STEEL TIMING GEARS generated and shaved to extreme accuracy for quiet operation.

THESE helical gears keep the cycloidal form, screw type rotors of the Standardaire Blower in timed relation. There is no wind-up

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Typical installation of a Standardaire Blower as installed in a malting plant.

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FULL ALLOY
STEEL UNIONS

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write for CATALOG 11 showing the complete Catawissa line

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In these days of high labor and material costs you can't afford to have rejects or seconds. Insure a

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These fittings—sold at same price as competing 150 lb. cast fittings—can be used where working pressures of up to 1000 lbs. are experienced.

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# SPARKLER FILTERS

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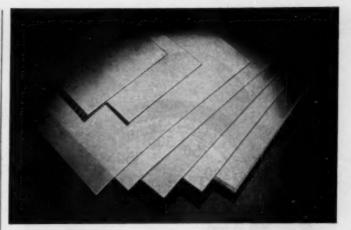




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Flexural Strength in 77 E	Did not breuk (DZ90-441)	for 66 psi.	270 F
		Surface Arc-Resistance	
Stiffness (ii 77 F	60,000 psi.		
Izad Impact Strength (c. 70 F	2.0 ft:-lb. in. 4.0 ft:-lb. in. 6.0 ftlb. in.		
77 9		Volume Resistivity	
170 F		Surface Resistivity (ii 100% )	
Durameter, Hardness	35 to 70		
Compressive Stress (it 0.1% Deformation	1700 psi	Dielectric Constant, 60 to 10 <sup>2</sup> Cycles	2.0-2.05
Deformation under Load (it 122 F, 1200 psi., 85 hr.	4 10 8%	Power Factor, 60 to 108 Cycles	
Coefficient of Linear Thermal		Water Absorption	
Expansion from 77 to 140 F	5.5 x 10 5 per deg. F	Flammability	Nonflammable
Thermal Conductivity	1.7 Btv. hr. 'sq. ff. deg fin	Resistance to Weathering	Excellent
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Above is pictured a typical burner WITH Iris Shutter con-trel. Graph and flame illustra-tion show the even flame and practically perfect control of air through your entire range.

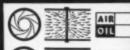


Burner without Iris Shutter shows air turbulance and wa-even flame with fluxuating air volume indicating poor control.

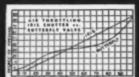


Centrol of air volume through Iris Shutter versus butter-fit valve at 60% angle of opening.

OIL

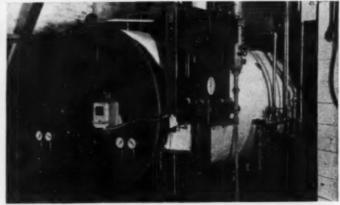


OIL Control of air volume through Iris Shutter versus butter-fly valve at 30% angle of opening. Note difference in volume con-trol of air and oil.



Above graph shows comparsion hetween Iris Shutter and hutter-fly valves normally used in sil or gas burners. Note the per-fect central with Iris Shutter.

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iris shutter

precise metering and rapid mixing of air and fuel in "Steam-Pak" burners - see Iris Shutter explanation at left.

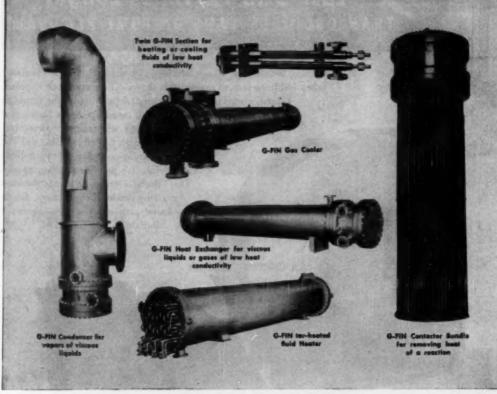
"Steam-Pak" Generators are built in capacities from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil, or straight gas. Ask for Bulletin No. 37-43. See your nearest York-Shipley dealer, or write, 'phone or wire

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GR-991

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New 150 - pound O. S. & Y. Gate Valve. Flanged ends, bolted flanged bonnest. Outside screw stem rises through revolving bushing. Precision fitted, accurately guided solid or split wedges are interchangeable. Sizes ¼ to 2°, incl. All dimensions of flanged end valves conform to MSS Standard SP-42. Available in 18-85, 18-85 Mo, Monel Metal, Nickel, Ampoc, Everdur, Hastelloy Alloys and Durinnet 20.

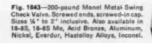




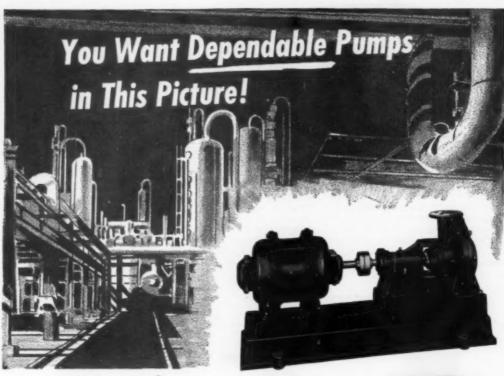
Fig. 1839—150-pound Nickel Globe Valve. Flanged ends and bolted flanged bonnet. Sizes 254° and 3°. Also available in Pure Silver, 18-85 Me, Monet Metal, Aluminum and Inconst.



Fig. 2453 G.—Large size 150-pound Stainless Steel Gate Valve. Flanged ends, belted flanged bennet, outside screw rising stem and yoke. Accurately guided, interchangeable solid or split wedges can be furnished. All dimensions of flanged end valves conform to MSS Standard SP-42. Available in a large selection of Corrosion-Resisting Metals and Alloys.

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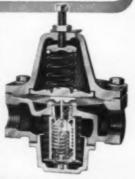
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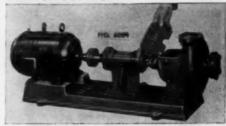
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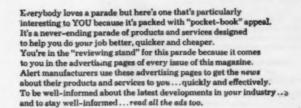
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and Bulletin 380 on Tube Expanders

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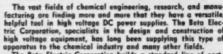
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10—Sweetland Filters. #12, 16, 7, 2, 1 & Laboratory Siss.

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10—Alsop Bronze & Brans Filters. Model # PAK 12, 4.

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3—Oliver Rotary Filters. #\*all\*, 8\*al2\* & 3 xd\*.

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1—Bharples Super Pressurite Centrituges #5.

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1—Bodyles Bayer Pressurite Centrituges #5.

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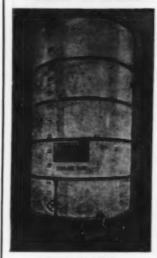
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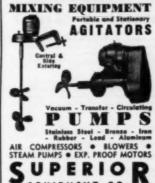
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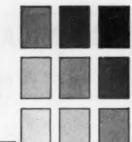
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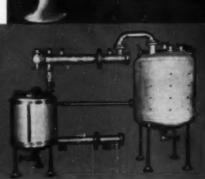
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